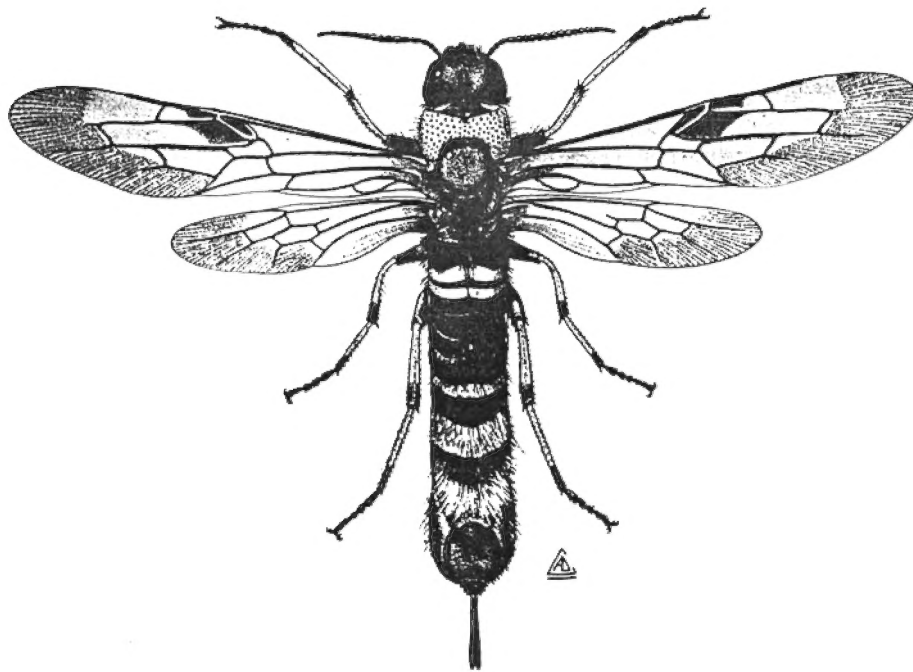


# BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA



*Eriotremex formosanus* (Matsumura)

Sawflies (Symphyta) are a diverse and economically important group of insects related to bees, wasps, and ants. The lead article of this issue contains the first published checklist of the Virginia fauna, which includes 345 confirmed species in 11 families.

# BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA

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*Cover:* Sawfly (*Eriotremex formosanus*), pen and ink drawing by Art Cushman.

*Back cover:* Gray Treefrog (*Hyla versicolor*), pen and ink drawing by Will Brown.

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Number 28, 2006

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## List of the Sawflies (Hymenoptera: Symphyta) of Virginia

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### ABSTRACT

Confirmed records for 345 species of sawflies in 11 families are cited for Virginia. The results are based on extensive Malaise trap collecting at several sites, mainly in northern Virginia, and data from museum specimens. A list of 23 potential species likely to occur in Virginia is given. County records and recorded host plants are given for each species.

*Key words:* Argidae, Cephidae, Cimbicidae, Diprionidae, Orussidae, Pamphiliidae, Pergidae, Siricidae, Tenthredinidae, Xiphydriidae, Xyelidae.

### INTRODUCTION

Sawflies, a general term for members of the suborder Symphyta (Hymenoptera), are, with the exception of Orussidae, phytophagous in the larval stage. The caterpillar-like larvae are often confused with those of Lepidoptera, and some of the damage to plants may be attributed to Lepidoptera by the untrained observer. Larvae of a number of sawfly species can cause economic damage in forests, agricultural crops, and ornamental plants. Adults are short-lived and are less conspicuous and usually less commonly collected than larvae.

No modern comprehensive state list of sawflies exists and no other state has been so thoroughly sampled for sawflies as Virginia. Without other state lists, comparisons of numbers cannot be made, but simply the 345 species recorded herein represent about one-third of the known fauna of America north of Mexico (Smith, 1979a). Older state lists exist, but the nomenclature is so outdated that it is nearly impossible to accurately compare numbers. For the record, with approximate numbers of species and subspecies in parentheses, previous state lists include Colorado (85) (Ashmead, 1890), New Jersey (400) (MacGillivray, 1910), Connecticut (196) (MacGillivray, 1916), New York (445) (Bradley, 1928), and North Carolina (128)

(Brimley, 1938) with approximately 30 additions by Ahlstrom (1995). Smith & Barrows (1987) recorded 117 species from urban environments in the Washington, DC, area.

This list is intended as a precursor for a comprehensive taxonomic treatment of the sawflies of Virginia and neighboring states. Additional material and collections to examine are welcome.

### MATERIALS AND METHODS

Most of the records are from my collecting efforts over the past 25 or more years; other records are from the collections at VPI&SU, Blacksburg, VA; the National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM); and a few from collections of other institutions (see acknowledgments). I have examined over 100,000 specimens for this study.

Sawfly sampling is most efficiently done with Malaise traps, and most records from the following counties are from sites where Malaise traps were used in several consecutive years. These localities are as follows (see Fig. 1):

Augusta Co., Deerfield Ranger District, George Washington National Forest, centered at 38° 07' 30" N, 79° 22' 30" W, with traps set at elevations of 561-744 m along the southeast slope of Great North Mountain.

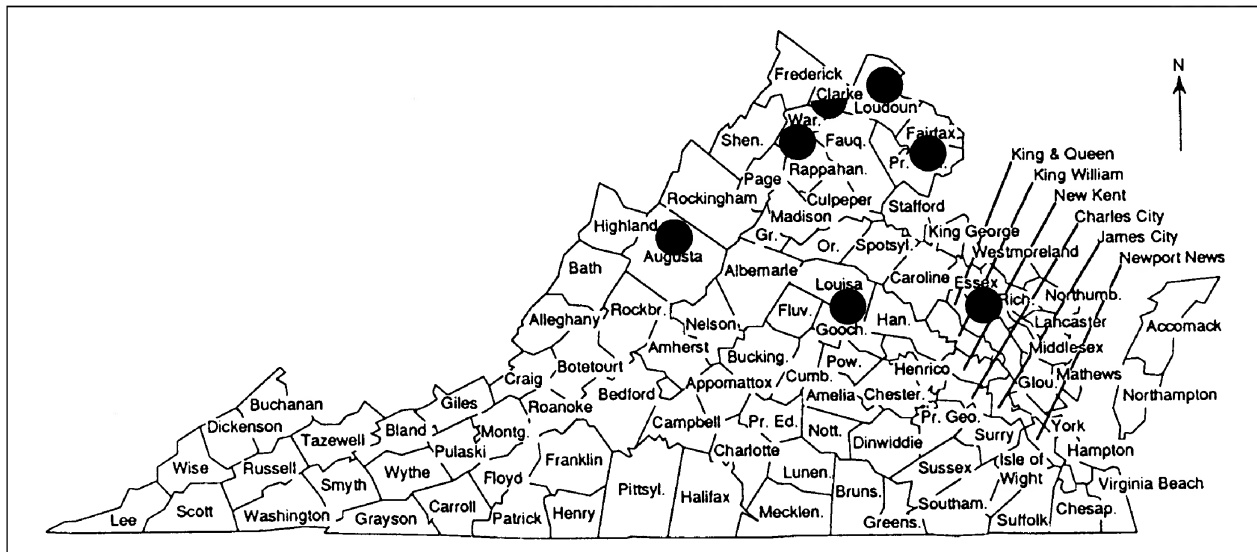


Fig. 1. Counties in Virginia. Dots indicate intensive sampling sites mentioned in Materials and Methods.

Five years collecting, 1995-1999, 20 traps per year, in mixed oak-pine forests. See studies by Braud et al. (2003) and Strazanac et al. (2003).

Clarke Co., University of Virginia Blandly Experimental Farm and State Arboretum of Virginia, 3 km [“2 mi” on labels] S Boyce, 39° 52' N, 78° 10' W. Six years collecting, 1990-1996, with 10-15 traps per year. Over 600 acres (~1,300 ha) of various habitats, such as ponds, willow, and oak-hickory stands, and a large selection of trees and shrubs in the Arboretum.

Essex Co., 1.6 km [“1 mi” on labels] SE Dunnsville, 37° 52' N, 76° 48' W. Nine years collecting, 1991-1999, with 15-20 traps each year. About a 100 acre (~250 ha) site of mixed hardwoods and pine, sandy soil, in the Coastal Plain.

Fairfax Co., near Annandale, 38° 50' N, 77° 12' W. Twenty-six years collecting, 1981-2006, with one trap each year in the backyard of a suburban development.

Loudoun Co., near jct. of Sycolin Road and Goose Creek. Two years collecting, 1998-1999, with five traps each year. Floodplain area with mixed vegetation near Goose Creek.

Louisa Co., 6 km [“4 mi” on labels] S Cuckoo. Five years collecting, 1985-1989, with 10-15 traps each year set up on a 560 acre (~1,200 ha) site; oak, hickory, mixed pine, rolling hills, stream drainages, interspersed among grazing pastures.

Warren Co., near Linden. Two years collecting, 1993-1994, one trap in streambed.

Most specimens from the above collections are deposited in the USNM. Specimens from the Augusta County study are in the insect collection of West Virginia University, Morgantown, with representatives

in the USNM.

The traps at each site were set up in March or April and taken down in September or October, thus allowing continual sampling through the season. Collections were made and preserved in 95% ethyl alcohol and traps were serviced every two or three weeks, depending on the time of the season and the weather. Various habitats were sampled within each site.

The list is arranged by family (and by subfamily in the Tenthredinidae) according to Smith (1979a). The scientific name is followed by the common name, if any; counties from which I have examined specimens; note if an introduced species; recorded host plants (most are from Smith 1979a and most are recorded only by host-plant genus); and references or other miscellaneous notes. References are mostly restricted to studies in Virginia and general literature that may help in identification. Other references may be found in Smith (1979a).

## RESULTS

Most records are from the collection sites listed above. Many species are probably common throughout the state, such as some found on cultivated roses, oaks, and other widespread plants. Because of its proximity, northern Virginia is the best sampled area in this study, and with my field work in the Coastal Plain (Essex County), Piedmont (Fairfax and Louisa counties), and Shenandoah Valley (Clarke County), and studies by Braud et al. (2003) and Strazanac et al. (2003) in the Appalachians (Augusta County), I have obtained samples from a good cross-section of the state. Species

richness increases inland. In nine years of collecting in Essex County, I obtained about 170 species; in five years in Louisa and six years in Clarke counties, about 200 species at each site. However, the approximately 110 species collected in Augusta County are low because the traps were set within the forest. About 120 species have been taken over 26 years in a backyard trap in a suburban habitat in Fairfax County.

The following checklist presents records for 345 species I have examined, plus 23 species which I believe eventually will be found in the state. The list is not exhaustive and additional species are expected, most likely from parts of the state that have not been well sampled. More collections are needed in the higher elevations of the Appalachians and in southern and southwestern Virginia. There are some species that have been found in the Northeast, e.g., New York, Pennsylvania, higher elevations of West Virginia, and the mountains of Tennessee and North Carolina, for which there are no Virginia records. Certainly, some of these eventually will be found in Virginia.

Keys to genera of certain families or subfamilies are in references to revisions given under those taxa. The most comprehensive keys to families and genera are by Goulet (1992, 1993). Ross (1937) is still helpful for family, subfamily, and some generic identifications.

#### XYELIDAE

*Xyela* larvae feed in the staminate cones of pines, *Pinus* spp., except *X. gallicaulis* which is a shoot borer. Species of *Xyela* are the earliest sawflies to fly in the spring; my earliest collection date is February 17 in Fairfax County. *Megaxyela* and *Macroxyela* larvae are external leaf feeders; adults are rarely collected. See Burdick (1961) for identification of *Xyela* and Smith & Schiff (1998) for *Macroxyela* and *Megaxyela*.

*Macroxyela ferruginea* (Say).

Clarke, Fairfax, Montgomery. Host: *Ulmus*. Adults swept from elms, *Ulmus* spp., in the Arboretum during the first half of April.

*Megaxyela bicoloripes* (Rohwer).  
Arlington.

*Megaxyela major* (Cresson).  
Arlington (identity uncertain, based on larvae). Host: Larvae "on hickory."

*Xyela alpigena* (Strobl).  
Augusta, Botetourt, Clarke, Fairfax. Host: *Pinus*.

*Xyela bakeri* Konow.  
Essex, Fairfax, King William, Nelson. Host: *Pinus*.

*Xyela gallicaulis* Smith.  
King and Queen. Host: *Pinus* (Smith, 1970).

*Xyela minor* Norton.  
Arlington, Botetourt, Essex, Fairfax, Fauquier, King and Queen, King William, Louisa, New Kent, Stafford. Host: *Pinus*.

*Xyela obscura* (Strobl).  
Arlington, Clarke, Essex, Fairfax, Fauquier, Henry, King and Queen, King William, Louisa, Montgomery, New Kent, Stafford. Host: *Pinus*.

*Xyela styra* Burdick.  
Arlington, Essex, Fairfax. Host: *Pinus*.

#### PAMPHILIIDAE

Larvae of *Acantholyda*, *Cephalaria*, and *Neurotoma* are gregarious and live and feed in webs of their own making on their host plant. Larvae of *Onycholyda* and *Pamphilius* are leaf rollers. See Middlekauff (1958, 1964) for revisions of this family; species currently placed in the genus *Onycholyda* were treated by Middlekauff (1964) as *Pamphilius* in couplets 1-10 and 15-31 of his key.

*Acantholyda angulata* (MacGillivray).  
Essex. Host: *Pinus*.

*Acantholyda atripes* (Cresson).  
Henrico. Host: *Pinus taeda* L.

*Acantholyda bicolorata* (Norton).  
Essex.

*Acantholyda circumcincta* (Klug).  
Essex. Host: *Pinus*.

*Acantholyda maculiventris* (Norton).  
Clarke. Hosts: *Abies*, *Picea*, *Pinus*.

*Acantholyda marginiventris* (Cresson).  
Fairfax, Montgomery.

*Acantholyda ochrocera* (Norton).  
Clarke.

*Acantholyda pini* Rohwer.  
Fairfax, Nottoway.

*Acantholyda tessellata* (Klug).  
Essex, Fauquier. Host: *Pinus*.

*Acantholyda zappei* (Rohwer).  
Augusta, Essex, City of Lynchburg. Host: *Pinus*.

*Cephalcia marginata* Middlekauff.  
"Va." Host: *Pinus*.

*Neurotoma fasciata* (Norton).  
Arlington, Augusta, Essex, Fairfax, Louisa.  
Host: *Prunus*.

*Neurotoma inconspicua* (Norton).  
Plum web-spinning sawfly. Clarke. Host: *Prunus*.

*Neurotoma willi* Middlekauff.  
Rockingham. Host: *Crataegus* (?).

*Onycholyda amplexa* (Fabricius).  
Albemarle, Arlington, Clarke, Essex, Fairfax, Loudoun,  
Louisa, Rockingham, Shenandoah, City of Suffolk.  
Host: *Rubus*.

*Onycholyda excavata* (Norton).  
Arlington, Essex, Loudoun, Louisa, Montgomery.  
Host: *Cornus*.

*Onycholyda luteicornis* (Norton).  
Arlington, Augusta, Clarke, Essex, Fairfax, Highland,  
Loudoun, Louisa, Montgomery, Rockingham, Warren.  
Host: *Rubus*.

*Onycholyda multisignata* (Norton).  
Montgomery.

*Onycholyda quebecensis* (Provancher).  
Augusta, Clarke, Essex, Fairfax, Louisa, Warren.

*Onycholyda rufofasciata* (Norton).  
Clarke, Essex, Fairfax, Loudoun, Louisa, Smyth,  
Warren.

*Pamphilius burquei* (Provancher).  
Giles.

*Pamphilius greenei* Rohwer.  
Essex.

*Pamphilius middlekauffi* Shinohara & Smith.  
Arlington, Augusta, Essex, Fairfax, Fauquier, Loudoun,  
Louisa. Host: *Corylus*.

*Pamphilius ochreipes* (Cresson).  
Arlington, Augusta, Clarke, Essex, Fairfax, Louisa.  
Host: *Viburnum*.

*Pamphilius ocreatus* (Say).  
Clarke, Essex, Louisa.

*Pamphilius pallimaculus* (Norton).  
Augusta, Clarke, Essex, Giles. Host: Adults collected  
from *Rosa*.

*Pamphilius persicum* MacGillivray.  
Essex, Loudoun, Louisa. Host: *Prunus*.

*Pamphilius phyllisae* Middlekauff.  
Clarke, Culpeper, Essex, Fairfax, Giles, Loudoun,  
Warren. Host: *Quercus*.

*Pamphilius pullatus* (Cresson).  
Clarke, Fairfax, Rockingham. Host: *Viburnum*.

*Pamphilius rileyi* (Cresson).  
Augusta, Fairfax, Warren. Host: *Amelanchier*.

*Pamphilius semicinctus* (Norton).  
Essex, Fairfax. Hosts: *Amelanchier*, *Pyrus*, *Prunus*.

## PERGIDAE

All larvae are external leaf feeders, feeding and skeletonizing the leaf from the underside. The genus needs study. *Acordulecera dorsalis* is a complex of color forms and probably several species are masquerading under this name. There are two or three additional species which are not recorded below. The following list (as given by Smith, 1979a) will have to suffice until taxonomic problems are resolved.

*Acordulecera dorsalis* Say.  
Augusta, Clarke, Essex, Fairfax, Franklin, Loudoun,  
Louisa, Montgomery, Warren. Hosts: *Castanea*, *Carya*,  
*Juglans*, *Quercus*.

*Acordulecera maculata* MacGillivray.  
Augusta, Clarke, Essex, Fairfax, Loudoun, Louisa.

*Acordulecera mellina* MacGillivray.  
Augusta, Essex, Fairfax, Loudoun.

*Acordulecera pellucida* (Konow).  
Augusta, Clarke, Essex, Fairfax, Loudoun,  
Montgomery, Warren.



## ARGIDAE

All except *Schizocerella pilicornis* are external leaf feeders; *S. pilicornis* larvae mine leaves of *Portulaca*. Smith (1969d, 1971b, 1989) treated the North American Argidae.

*Arge abdominalis* (Leach).

Essex, Loudoun, Louisa. Host: *Rhododendron canescens* (Michx.) Sweet.

*Arge azaleae* Smith.

Skyline Drive [Shenandoah National Park]. Host: *Rhododendron vicosum* (L.) Torr., *Rhododendron* sp.

*Arge cerulea* (Norton).

Essex, Fairfax, Loudoun.

*Arge coccinea* (Fabricius).

Arlington, Essex, Fairfax, New Kent, City of Norfolk, Prince William, City of Virginia Beach. Hosts: *Rhus copallinum* L., *R. glabra* L., *Rhus* sp.

*Arge cyra* (Kirby).

Fairfax. Hosts: *Betula*, *Salix*.

*Arge humeralis* (Beauvois).

Accomack, Arlington, City of Chesapeake, Clarke, Essex, Fairfax, Fauquier, Giles, City of Hampton, Louisa, Madison, Montgomery, Nelson, New Kent, City of Norfolk, Northampton, Page, Prince William. Hosts: *Toxicodendron pubescens* P. Mill., *T. radicans* (L.) Kuntze, *T. vernix* (L.) Kuntze.

*Arge macleayi* (Leach).

Arlington, Augusta, Clarke, Fairfax, Grayson, Highland, Louisa, Page. Hosts: *Amelanchier*, *Prunus*, *Sorbus*.

*Arge onerosa* (MacGillivray).

Fairfax. Host: *Salix*.

*Arge pectoralis* (Leach). Birch sawfly.

Arlington, Augusta, Clarke, Essex, Fairfax, Louisa, Nelson, Page, Prince William. Hosts: *Alnus*, *Betula*, *Corylus*.

*Arge quidia* Smith.

Augusta, Essex, Fairfax, Giles, Montgomery, Prince William, Warren. Host: *Quercus*.

*Arge salicis* Rohwer.

Arlington, Fairfax. Host: *Salix*.

*Arge scapularis* (Klug).

Amherst, Clarke, Fairfax, Giles, Louisa, Nelson, City of Richmond, Warren. Host: *Ulmus*.

*Arge willi* Smith.

Augusta, Essex, Fairfax, Louisa, Prince William, Wythe. Host: *Corylus*.

*Atomacera debilis* Say.

Arlington, Clarke, Essex, Fairfax, Louisa, Nelson, Page, Rockingham, Shenandoah. Hosts: *Desmodium*, *Lepedeza*.

*Atomacera decepta* Rohwer.

Clarke, Essex, Fairfax, Greene, Louisa, Montgomery, Prince William, Washington. Hosts: Common on some ornamental hibiscus: hardy herbaceous hibiscus, scarlet rose, crimson-eyed rose mallow, confederate rose (*Hibiscus mutabilis* L.), *Hibiscus moscheutos* L. cultivars (Boyd, 2005).

*Schizocerella lineata* (Rohwer).

Fairfax. Host: *Portulaca oleraceae* L. An external feeder.

*Schizocerella pilicornis* (Holmgren). Purslane sawfly.

Arlington, Augusta, Clarke, Essex, Fairfax, Louisa, Montgomery, Page, Westmoreland. Host: *Portulaca oleraceae* L. A leafminer.

*Sphacophilus cellularis* (Say).

Augusta, Clarke, Essex, Fairfax, King George, Loudoun, Louisa, City of Norfolk, Northampton, City of Virginia Beach, Westmoreland. Hosts: *Ipomoea*, *Convolvulus*. See Chapman & Gould (1929).

*Sterictiphora cruenta* Smith.

Essex. Host: *Prunus*.

*Sterictiphora sericea* (Norton).

Clarke, Essex, Louisa.

*Sterictiphora serotina* Smith.

Augusta, Clarke, Essex, Fairfax, Louisa, Page. Host: *Prunus serotina*.

*Sterictiphora transversa* Smith.

Clarke, Louisa.

## CIMBICIDAE

All larvae are external leaf feeders. The species of *Cimbex* and *Trichiosoma* are seldom collected in the state.

*Abia lonicerae* (Linnaeus).

Clarke, Essex, Fairfax, Halifax, Loudoun, Louisa, Montgomery, Patrick, Roanoke, Stafford, Warren, Wise. Host: *Lonicera*. In previous literature as *Zaraea lonicerae* (Smith, 1979a). An introduced species.

*Cimbex americana* Leach. Elm sawfly.

Bath, Fairfax, Giles, Highland, Montgomery, Rockbridge, Shenandoah. Hosts: *Acer*, *Alnus*, *Betula*, *Malus*, *Populus*, *Prunus*, *Salix*, *Ulmus*.

*Trichiosoma triangulum* Kirby.

Montgomery, Roanoke, Smyth. Host: *Alnus*.

## DIPRIONIDAE

All species feed on foliage of conifers and some can cause serious damage during outbreaks. Some are destructive on ornamentals. *Abies*- and *Tsuga*-feeding species eventually may be found at higher elevations. The treatment of *Neodiprion* by Ross (1955) is helpful for identification.

*Diprion similis* (Hartig). Introduced pine sawfly.

Fairfax, Grayson, Smyth, Washington, Wythe. Host: *Pinus strobus* L. See Thomas et al. (1982) for southwestern counties. An introduced species.

*Monoctenus melliceps* (Cresson).

Clarke, Essex, Louisa. Host: *Juniperus*.

*Neodiprion abbotii* (Leach).

Clarke, Essex, Fairfax, Louisa, Powhatan, Prince Edward. Hosts: *Pinus taeda* L. probably preferred; also, *P. echinata* Mill., *P. palustris* Mill., *P. resinosa* Ait. See Hetrick (1956).

*Neodiprion compar* (Leach).

Essex, Fairfax, King and Queen, City of Norfolk, Patrick. Hosts: *Pinus banksiana* Lamb., *P. resinosa* Ait.

*Neodiprion excitans* Rohwer.

Blackheaded pine sawfly. King and Queen. Hosts: *Pinus echinata* Mill., *P. elliottii* Engelm., *P. rigida* Mill., *P. serotina* Michx., *P. taeda* L. See Hetrick

(1956).

*Neodiprion hetricki* Ross.

Caroline, Essex, Mathews. Host: *Pinus taeda* L. See Hetrick (1956).

*Neodiprion lecontei* (Fitch). Redheaded pine sawfly.

Albemarle, Augusta, Bedford, City of Chesapeake, Essex, Fairfax, James City, New Kent, Prince Edward, Richmond. Host: *Pinus*; various pines. Especially common on ornamentals.

*Neodiprion nannulus nannulus* Schedl.

Wise. Host: *Pinus virginiana* Mill.

*Neodiprion pinetum* (Norton). White pine sawfly.

Fluvanna, Rappahannock, City of Staunton. Host: *Pinus strobus* L.

*Neodiprion pratti prattii* (Dyar). Virginia pine sawfly.

Albemarle, Buckingham, Culpeper, Cumberland, Fairfax, Gloucester, Halifax, King and Queen, Louisa, Mecklenburg, Middlesex, Nelson, Prince Edward. Hosts: *Pinus echinata* Mill., *P. palustris* Mill., *P. resinosa* Ait., *P. taeda* L., *P. virginiana* Mill. See Hetrick (1956), Morris et al. (1963), and Bobb (1963, 1965) for reports of extensive outbreaks in the 1950s and early 1960s.

*Neodiprion taedae taedae* Ross.

Spotted loblolly pine sawfly. Accomack, Essex, King and Queen, King William, Mathews, Middlesex. Host: *Pinus taeda* L. See Hetrick (1941, 1956).

*Neodiprion virginiana* Rohwer.

Caroline, Fairfax. Host: *Pinus taeda* L.

## TENTHREDINIDAE

## Selandriinae

Most species are associated with ferns, with one on moss. The grass- or sedge-feeding species have not been found in Virginia. Smith (1969c) revised this subfamily for North America.

*Aneugmenus flavipes* (Norton).

Arlington, Augusta, Clarke, Essex, Fairfax, Giles, Grayson, Louisa, City of Norfolk, Page, Wythe. Hosts: *Pteridium aquilinum* (L.) Kuhn and probably other ferns.

*Hemitaxonus albidipictus* (Norton).

Arlington, Augusta, Bedford, Clarke, Essex, Fairfax, Louisa, Warren. Hosts: ferns.

*Hemitaxonus dubitatus* (Norton).

Arlington, Clarke, Essex, Fairfax, Louisa, Page. Host: *Onoclea sensibilis* L. Common on this fern in gardens.

*Heptamelus ochroleucus* (Stephens).

Fairfax. Introduced (Smith, 2003). Hosts: In Europe, *Athyrium*, *Blechnum*, *Polypodium*. Larvae bore in stems.

*Nesoselandria morio* (Fabricius).

Fairfax. Introduced (Smith, 2003). Host: moss.

*Strongylogaster impressata* Provancher.

Clarke, Essex, Fairfax, Louisa, Page, Warren. Hosts: ferns.

*Strongylogaster multicincta* Norton.

Arlington, Augusta, Essex, Montgomery. Host: *Pteridium aquilinum* (L.) Kuhn.

*Strongylogaster polita* Cresson.

Augusta, Essex, Louisa, Page.

*Strongylogaster remota* Rohwer.

Warren.

*Strongylogaster soriculatipes* Cresson.

Augusta, Loudoun, Warren. Hosts: ferns.

*Strongylogaster tacita* (Norton).

Arlington, Essex, Fairfax, Giles, Highland, Louisa, Tazewell. Hosts: ferns. Adults taken from *Pteridium aquilinum* (L.) Kuhn. and *Osmunda regalis* L. (Goulet, pers. comm.).

## Dolerinae

Larvae of most species feed on grasses, including grain crops; several are on *Equisetum*. Goulet (1986) revised this group for North America, treating it as a tribe of the Selandriinae.

*Dolerus abdominalis* (Norton).

Louisa.

*Dolerus agcistus* MacGillivray.

Clarke.

*Dolerus alutaceus* Goulet.

Rockingham.

*Dolerus apricus* (Norton).

Arlington, Charlotte, Clarke, Fairfax, Fauquier, Montgomery. Host: *Equisetum*.

*Dolerus aprilis* (Norton).

Bland, Craig, Fairfax, City of Hampton, Montgomery, York.

*Dolerus bicolor* (Beauvois).

Essex, Loudoun, Louisa, Montgomery.

*Dolerus centralis* Ross.

Clarke, Fairfax, Louisa.

*Dolerus hebes* Goulet.

Augusta, Clarke, Essex, Louisa.

*Dolerus kennedyi* Ross.

Louisa.

*Dolerus klokeorum* Goulet & Smith.

Essex, Fairfax, Louisa.

*Dolerus neoagcistus* MacGillivray.

Arlington, Bedford, Clarke, Essex, Fairfax, Loudoun, Louisa, Montgomery, Pulaski, Rockingham, Stafford.

*Dolerus neocollaris* MacGillivray.

Clarke.

*Dolerus neosericeus* MacGillivray.

Grayson.

*Dolerus nitens* Zaddach.

Bedford, Clarke, Fairfax, Giles, Loudoun, Montgomery, Warren. Introduced. Hosts: grasses. A common, early sawfly in northern Virginia. None were collected in Essex and Louisa counties from 1985 through 1999.

*Dolerus nortoni* Ross.

Clarke, Fairfax.

*Dolerus polysericeus* MacGillivray.

Giles.

*Dolerus sericeus* Say.

Clarke, Louisa, Montgomery. Host: wheat.

*Dolerus subfasciatus* Smith.

Clarke, Montgomery.

*Dolerus tibialis conjugatus* MacGillivray.

Charlotte, Craig, Fairfax, Giles, Montgomery,

Rockingham, Washington. Host: *Equisetum*.

*Dolerus unicolor* (Beauvois).

Augusta, Bedford, Clarke, Craig, Fairfax, Fauquier, Louisa, Montgomery, Pulaski, Rockingham, Tazewell, Wythe. Hosts: grasses.

*Dolerus versus* Norton.

Clarke, Essex, Fairfax, Louisa, City of Richmond.

#### Nematinae

Most species are external leaf feeders. Larvae of *Euura* form stem galls on willow, *Pontania* form leaf galls on willow, *Phyllocolpa* form leaf rolls on poplar and willow, *Pseudodineura parva* is a leaf miner, larvae of *Caulocampus* are petiole miners, and larvae of *Hoplocampa* live and feed in developing fruits of their hosts. Several genera are relatively unstudied, and a complete listing cannot be given until taxonomic problems are resolved. These include *Amauronematus*, *Euura*, *Nematus*, *Pachynematus*, *Phyllocolpa*, and *Pontania*. Studies on these genera could increase this list by 20 or more species. Literature that may be helpful for species identification of some genera is as follows: *Caulocampus* (Smith, 1968); Cladiini (*Cladius*, *Priophorus*) (Smith, 1974); *Craesus* (Smith, 1972); *Craterocercus* (Smith, 1969a); *Hemichroa* (Smith, 1975b); *Hoplocampa* (Ross, 1943b); *Nepionema* (Smith, 1994a); *Pachynematus* (Ross, 1945); and *Pseudodineura* (Smith, 1976).

*Adelomos cleone* Ross.

Tazewell.

*Amauronematus amentorum* (Foerster).

Fairfax. Host: *Salix*.

*Amauronematus brunneus* (Norton).

Clarke.

*Amauronematus* nr. *lineatus* (Harrington).

Clarke.

*Amauronematus orbitalis* Marlatt.

Clarke, Fairfax, Louisa.

*Caulocampus matthewsi* Smith.

Giles.

*Cladius difformis* (Panzer). Bristly roseslug.

Albemarle, Arlington, Clarke, Fairfax, Loudoun, Montgomery, Rockingham. Host: *Rosa*. A common pest of cultivated roses.

*Craesus castaneae* Rohwer.

Fairfax, Franklin. Host: *Castanea*.

*Craesus latitarsus* Norton. Dusky birch sawfly.

Louisa. Host: *Betula*.

*Craterocercus fraternalis* (Norton).

Augusta, Clarke, Essex, Fairfax, Giles, Louisa, Montgomery, Rockingham, Warren. Host: *Quercus*.

*Craterocercus furcatus* Smith.

Clarke, Essex, Montgomery.

*Craterocercus obtusus* (Klug).

Augusta, Essex, Giles, Louisa, Rockingham. Host: *Quercus*.

*Euura salicicola* Smith ?.

Clarke, Fairfax. Host: *Salix*. The species identity is questionable.

*Hemichroa militaris* (Cresson).

Clarke, Giles, Grayson, Montgomery, Page, Washington. Hosts: *Amelanchier*, *Prunus*.

*Hoplocampa halcyon* (Norton).

Essex, Fairfax, Franklin. Host: *Amelanchier*.

*Hoplocampa marlatti* Rohwer.

Arlington, Augusta, Clarke, Essex, Fairfax, Louisa. Host: probably *Prunus*.

*Nematus abbotii* (Kirby).

Augusta, Clarke, Essex, Fairfax, Loudoun, Warren. Host: *Robinia*.

*Nematus* nr. *atriceps* (Marlatt).

Augusta.

*Nematus attus* Smith.

Montgomery. Host: *Populus*.

*Nematus carpini* (Marlatt).

Bedford, Fairfax, Louisa, Patrick. Host: *Carpinus*.

*Nematus corylus* Cresson.

Clarke, Essex, Fairfax, Louisa, Warren. Host: *Corylus*.

*Nematus erythrogaster* Norton.

Arlington, City of Chesapeake, Clarke, Essex, Fairfax, Louisa. Host: *Alnus*.

*Nematus hudsoniimagnus* Dyar.

Clarke, Louisa, Rockingham. Host: *Populus*.

- Nematus laticulus* (Norton).  
Clarke, Essex, Fairfax, Frederick, Montgomery, Orange.  
Loudoun, Louisa, Montgomery, City of Richmond, Rockingham, Warren. Hosts: *Carex* and possibly grasses.
- Nematus latifasciatus* Cresson.  
Grayson. Host: *Betula*.
- Nematus limbatus* Cresson.  
Clarke. Hosts: *Salix*, *Populus*.
- Nematus lipovskyi* Smith.  
Augusta, Clarke, Essex, Fairfax, Louisa, Loudoun.  
Host: *Rhododendron*.
- Nematus oligospilus* Foerster.  
Arlington, Charlotte, Clarke, Fairfax, Louisa, Montgomery, City of Suffolk. Host: *Salix*.
- Nematus ostryae* (Marlatt).  
Augusta, Giles, Fairfax, Fauquier. Host: *Ostrya*.
- Nematus radialis* Smith.  
Augusta, Clarke.
- Nematus ribesii* (Scopoli). Imported currantworm.  
Clarke, Fairfax. Host: *Ribes*.
- Nematus salicisodoratus* Dyar.  
Clarke, Essex, Fairfax, Louisa, Montgomery. Hosts: *Populus*, *Salix*.
- Nematus superbus* (Provancher).  
Fairfax, Highland, Rockbridge.
- Nematus tibialis* Newman.  
Accomack, Arlington, Augusta, Clarke, Essex, Fairfax, Fauquier, King and Queen, King William, Loudoun, Louisa, Montgomery, Page, Patrick, Rockingham, Shenandoah, Warren. Host: *Robinia pseudoacacia* L.
- Nematus ventralis* Say. Willow sawfly.  
Arlington, Clarke, Fairfax, Montgomery, City of Richmond. Host: *Salix*.
- Neopareophora litura* (Klug).  
Arlington, Augusta, Clarke, Essex, Fairfax, Louisa, Montgomery, Page, Warren. Host: *Vaccinium*.
- Nepionema appalachiana* Smith.  
Essex.
- Pachynematus corniger* (Norton).  
Arlington, Augusta, Clarke, Essex, Fairfax, Giles,
- Pachynematus extensicornis* (Norton). Grass sawfly.  
Augusta, Clarke, Essex, Loudoun, Montgomery. Hosts: wheat, probably other grasses.
- Phyllocolpa nigrita* (Marlatt).  
"Virginia."
- Phyllocolpa populi* (Marlatt) (?).  
Clarke.
- Pontania gracilis* Marlatt.  
"Va." Host: *Salix*.
- Priophorus morio* (Lepeletier).  
Clarke. Host: *Rubus*.
- Priophorus pallipes* (Lepeletier).  
Arlington, Augusta, Clarke, Essex, Fairfax, Louisa, Washington. Hosts: *Alnus*, *Crataegus*, *Prunus*.
- Pristiphora abbreviata* (Hartig). California pear sawfly.  
Clarke, Fairfax, Fauquier, Louisa, Rockingham.  
Introduced. Host: *Pyrus*.
- Pristiphora acidovalva* Wong.  
Clarke, Fairfax, Louisa. Host: *Salix*.
- Pristiphora appendiculata* (Hartig).  
Clarke, Essex, Fairfax, Giles, Louisa, Page, Warren.  
Host: *Ribes*. In previous literature as *Pristiphora rufipes* Lepeletier.
- Pristiphora banksi* Marlatt.  
Accomack, Augusta, Clarke, Essex, Fairfax, Giles, Loudoun, Louisa, City of Suffolk, City of Virginia Beach, Warren. Host: *Vaccinium*.
- Pristiphora bivittata* (Norton).  
Augusta, Clarke, Fairfax, Loudoun, Montgomery, Rockingham, Warren. Host: *Spiraea*.
- Pristiphora chlorea* (Norton).  
Augusta, Clarke, Essex, Fairfax, Fauquier, Loudoun, Louisa, Montgomery, Roanoke, Warren. Host: *Quercus*.
- Pristiphora cincta* Newman.  
Augusta, Clarke, Essex, Fairfax, Giles, Grayson, Louisa, Smyth. Hosts: *Betula*, *Salix*, *Vaccinium*.

*Pristiphora erichsonii* (Hartig). Larch sawfly.  
Montgomery. An introduced species. Host: *Larix*.

*Pristiphora geniculata* (Hartig). Mountain ash sawfly.  
Grayson. Host: *Sorbus*.

*Pristiphora mollis* (Hartig).  
Clarke, Louisa, Warren. Host: *Vaccinium*.

*Pristiphora paloma* Wong & Ross.  
Clarke, Fairfax.

*Pristiphora siskiyouensis* Marlatt.  
Essex, Fairfax, Halifax, Louisa. Hosts: *Alnus*, *Betula*.

*Pristiphora sycophanta* Walsh.  
Arlington, Clarke, Craig, Fairfax, Essex, Louisa. Host: *Salix*.

*Pristiphora zella* Rohwer.  
Augusta, Clarke, Fairfax, Giles, Louisa, Warren.

*Pseudodineura parva* (Norton).  
Clarke, Essex, Louisa. Host: *Hepatica*.

#### Heterarthrinae

Larvae of *Caliroa* and *Endelomyia* are external leaf feeders. *Caliroa cerasi* may be a pest in orchards and *E. aethiops* a pest of cultivated roses. Species of the remaining genera are leaf miners in their host plants. Smith (1971a) revised this subfamily for North America.

*Caliroa cerasi* (Linnaeus). Pear sawfly.  
Arlington, Fairfax. Hosts: *Pyrus*, *Prunus*, *Crataegus*, and probably other Rosaceae.

*Caliroa fasciata* (Norton).  
Clarke, Essex, Fairfax, Louisa. Host: *Quercus*.

*Caliroa liturata* MacGillivray.  
Fairfax, City of Suffolk. Host: *Prunus*.

*Caliroa lobata* MacGillivray.  
Augusta, Clarke, Fairfax, Essex, Louisa. Host: *Quercus*.

*Caliroa lorata* MacGillivray.  
Arlington, Clarke, Fairfax, Louisa. Host: *Castanea*.

*Caliroa lunata* MacGillivray.  
Arlington, Augusta, Clarke, Essex, Fairfax, Louisa, Warren.

*Caliroa nyssae* Smith.  
Essex, Fairfax, Louisa. Host: *Nyssa sylvatica* Marsh.

*Caliroa obsoleta* (Norton).  
Arlington, Clarke, Essex, Fairfax, Louisa. Host: *Quercus*.

*Caliroa petiolata* Smith.  
Arlington, Caroline, Clarke, Essex, Louisa. Host: *Quercus*.

*Caliroa quercuscoccinea* (Dyar). Scarlet oak sawfly.  
Augusta, Clarke, Essex, Fairfax, Mecklenburg, Washington. Host: *Quercus*.

*Endelomyia aethiops* (Fabricius). Roseslug.  
Albemarle, Arlington, Clarke, Fairfax, Henrico, Loudoun, Montgomery, Rockingham. Host: *Rosa*, common on cultivated roses.

*Kaliofemusa ulmi* (Sundevall). Elm leafminer.  
Clarke. Introduced. Host: *Ulmus*. See Smith (1995) for discovery in Virginia.

*Metallus ochreus* Smith.  
Essex, Fairfax, Loudoun, Louisa.

*Metallus rohweri* MacGillivray.  
Arlington, Clarke, Essex, Fairfax, Loudoun, Louisa, Page. Host: *Rubus*.

*Nefusa ambigua* (Norton).  
Augusta, Clarke, Fairfax, Loudoun, Montgomery, Page. Host: *Viola*.

*Profenusa alumna* (MacGillivray).  
Augusta, Clarke, Fairfax. Host: *Quercus*.

*Profenusa canadensis* (Marlatt).  
Clarke, Page. Host: *Crataegus*.

#### Blennocampinae

All larvae are external leaf feeders except those of *Ardis brunniventris* which is a shoot borer in roses. Smith (1969b) revised this subfamily for North America.

*Ardis brunniventris* (Hartig).  
Clarke, Essex, Louisa, Page. Host: *Rosa*.

*Erythraspides carbonarius* (Cresson).  
Arlington, Clarke, Fairfax, Loudoun, Montgomery, Warren. Host: *Oenothera*.

*Erythraspides vitis* (Harris). Grape sawfly.

Albemarle, Augusta, Chesterfield, Clarke, Essex, Fairfax, Loudoun, Louisa, Smyth, Rockingham. Host: *Vitis*.

*Eupareophora parca* (Cresson).

Clarke, Essex, Fairfax, Henry, Loudoun, Louisa, Warren. Host: *Fraxinus*.

*Eutomostethus ephippium* (Panzer).

Arlington, Augusta, Clarke, Craig, Fairfax, Loudoun, Warren. Introduced. Hosts: *Poa*, possibly Graminae.

*Eutomostethus luteiventris* (Klug).

Clarke, Fairfax, Montgomery, Page. Introduced. Host: *Juncus*.

*Halidamia affinis* (Fallén).

Clarke, Essex, Fairfax, Loudoun, Louisa, Montgomery, Northampton, Page, Warren. Introduced. Host: *Galium*.

*Monophadnoides conspiculatus* MacGillivray.

Arlington, Augusta, City of Chesapeake, Clarke, Essex, Fairfax, Loudoun, Louisa.

*Monophadnoides pauper* (Provancher).

Augusta, Clarke, Essex, Fairfax, Giles, Louisa, Page, Warren.

*Monophadnoides rubi* (Harris). Raspberry sawfly.

Augusta, City of Chesapeake, Clarke, Essex, Fairfax, Loudoun, Louisa, Montgomery, Page, Warren. Host: *Rubus*. In previous literature as *Monophadnoides geniculatus* (Hartig) (Smith, 1979a).

*Monophadnus aequalis* MacGillivray.

Augusta, Clarke, Essex, Fairfax, Loudoun, Louisa, Page. Host: probably *Ranunculus*.

*Monophadnus bakeri* Smith.

Fairfax, Loudoun.

*Monophadnus pallescens* (Gmelin).

Clarke, Essex. Host: *Ranunculus*.

*Paracharactus niger* (Harrington).

Clarke, Loudoun, Louisa, Page. Host: probably sedges (*Carex*).

*Paracharactus rudis* (Norton).

Arlington, Augusta, Clarke, Essex, Fairfax, Loudoun, Louisa, Page, Warren.

*Periclista albicollis* (Norton).

Augusta, Clarke, Essex, Fairfax, Fauquier, Giles, Loudoun, Louisa, Page, Prince William, Rockingham, Warren. Host: *Quercus*.

*Periclista bipartita* (Cresson).

Louisa.

*Periclista diluta* (Cresson).

Augusta, Clarke, Essex, Giles, Loudoun, Louisa, Montgomery, Warren. Host: *Quercus*.

*Periclista inaequidens* (Norton).

Arlington, Essex, Page, Rockingham. Host: *Quercus*.

*Periclista marginicollis* (Norton).

Arlington, Augusta, Clarke, Essex, Loudoun, Louisa, Montgomery, Page, Rockingham, Warren. Host: *Carya*.

*Periclista media* (Norton).

Augusta, Essex, Fairfax, Rockingham, Warren. Host: *Quercus*.

*Periclista subtruncata* Dyar.

Essex, Fairfax, Fauquier, Loudoun. Host: *Quercus*.

*Phymatocera fumipennis* (Norton).

Arlington, Clarke, Culpeper, Essex, Fairfax, Giles, Loudoun, Louisa, Warren. Host: *Smilacina*.

*Phymatocera racemosae* Smith.

Clarke, Essex, Fairfax, Louisa, Warren. Host: *Polygonatum*.

*Phymatocera smilacinae* Smith.

Arlington, Loudoun. Host: Adults collected from *Polygonatum* and *Smilacina*.

*Rhadinoceraea nubilipennis* (Norton).

Page. Host: *Veratrum*.

*Stethomostus fuliginosus* (Schrank).

Clarke. Introduced. Host: *Ranunculus*.

*Tethida barda* (Say). Blackheaded ash sawfly.

Clarke, Essex, Fairfax, Giles, Loudoun, Louisa, Montgomery. Host: *Fraxinus*.

*Tomostethus multicinctus* (Rohwer).

Brownheaded ash sawfly. Fairfax. Host: *Fraxinus*.

## Allantinae

Larvae of all species are external leaf feeders. Smith (1979b) revised this subfamily for North America.

*Allantus cinctus* (Linnaeus). Curled rose sawfly.  
Fairfax. Hosts: *Fragaria*, *Rosa*.

*Allantus mellipes* (Norton).  
Clarke, Fairfax, Loudoun, Page, Roanoke, Tazewell.  
Host: *Fragaria*.

*Allantus nigrithibialis* Rohwer.  
Clarke, Fairfax, Loudoun. Host: *Rosa*.

*Allantus viennensis* (Schrank).  
Clarke, Fairfax, Loudoun. Introduced. Host: *Rosa*. See  
Smith (1975a).

*Ametastegia aperta* (Norton).  
Arlington, Augusta, Clarke, Essex, Fairfax, Giles,  
Lee, Louisa, Page, Warren.

*Ametastegia articulata* (Klug).  
Arlington, Chesterfield, Clarke, Essex, Fairfax, Giles,  
Loudoun, Louisa, Nelson, Northampton, Montgomery,  
Rockingham, Warren. Hosts: *Polygonum*, *Rumex*.

*Ametastegia becria* Smith.  
Augusta, Clarke, Essex, Fairfax, Giles, Louisa, Page,  
Warren.

*Ametastegia equiseti* (Fallén).  
Clarke, Essex, Fairfax, Louisa, Page. Host: *Rumex*.

*Ametastegia glabrata* (Fallén). Dock sawfly.  
Clarke, Louisa, Montgomery. Hosts: *Polygonum*,  
*Rumex*.

*Ametastegia pallipes* (Spinola). Violet sawfly.  
Arlington, Clarke, Fairfax, Louisa, Page, Patrick.  
Host: *Viola*.

*Ametastegia pulchella* (Rohwer).  
Arlington, Augusta, Clarke, Essex, Fairfax, Loudoun,  
Louisa, Prince William, Warren. Host: *Polygonum*.

*Ametastegia recens* (Say).  
Giles, Louisa.

*Ametastegia rocia* Smith.  
“Va.” Host: *Salix* (?).

*Ametastegia tener* (Fallén).  
Clarke, Essex, Fairfax, Montgomery, Page. Host:  
*Rumex*.

*Ametastegia xenia* Smith.  
Appomattox, Floyd.

*Dimorphopteryx autumnalis* Rohwer.  
Fairfax. Host: *Quercus*.

*Dimorphopteryx melanognathus* Rohwer.  
Giles. Hosts: *Alnus*, *Betula*.

*Dimorphopteryx pinguis* (Norton).  
Arlington, Augusta, Essex, Fairfax, King and Queen,  
Louisa. Hosts: *Alnus*, *Betula*.

*Dimorphopteryx virginicus* Rohwer.  
Arlington, Fairfax, Louisa. Host: *Castanea*.

*Empria coryli* (Dyar).  
Essex, Louisa, Warren. Host: *Corylus*.

*Empria evansi* Smith.  
Louisa.

*Empria maculata* (Norton).  
Accomack, Arlington, Augusta, Clarke, Essex, Fairfax,  
Grayson, Highland, Loudoun, Louisa, Madison,  
Page, City of Petersburg, Rockingham, Warren.  
Hosts: *Fragaria*, *Potentilla*, *Rubus*.

*Empria multicolor* (Norton).  
Arlington, Augusta, Chesterfield, Clarke, Essex,  
Fairfax, Fauquier, Floyd, Giles, Grayson, Highland,  
Louisa. Hosts: *Alnus*, *Betula*.

*Eriocampa juglandis* (Fitch).  
Clarke, Essex, Louisa. Host: *Juglans*.

*Macremphytus semicornis* (Say).  
Clarke. Host: *Cornus*.

*Macremphytus tarsatus* (Say).  
Augusta, Clarke, Loudoun, Warren. Host: *Cornus*.

*Macremphytus testaceus* (Norton).  
Arlington, Augusta, Clarke, Essex, Fairfax, Floyd,  
Giles, Loudoun, Louisa, Montgomery, Nelson,  
Rockingham. Host: *Cornus*.

*Monosoma inferentia* (Norton).  
Louisa. Host: *Alnus*.



*Monostegia abdominalis* (Fabricius).

Clarke, Essex, Fairfax, Louisa, Montgomery. Host: *Lysimachia*.

*Phrontosoma belfragei* (Cresson).

Fairfax. Host: *Cornus* (?).

*Pseudosiobla excavata* (Norton).

Arlington, Essex, Fairfax, Louisa, City of Richmond, Spotsylvania. Host: *Cephalanthus*.

*Taxonus borealis* MacGillivray.

Augusta.

*Taxonus epicera* (Say).

Augusta, Clarke, Essex, Fairfax, Lee, Loudoun, Louisa, City of Richmond, Warren.

*Taxonus pallicoxus* (Provancher).

Augusta, Clarke, Loudoun, Louisa. Host: *Fragaria*.

*Taxonus pallidicornis* (Norton).

Augusta, Clarke, Essex, Fairfax, Loudoun, Louisa, Montgomery, Warren. Host: *Rubus*.

*Taxonus pallipes* (Say).

Augusta, Clarke, Essex, Fairfax, Loudoun, Louisa, Warren. Host: *Fragaria*.

*Taxonus proximus* (Provancher).

Augusta, Louisa.

*Taxonus rufocinctus* (Norton).

Augusta, Clarke, Loudoun, Louisa. Host: *Rubus*.

*Taxonus spiculatus* (MacGillivray).

Augusta.

*Taxonus terminalis* (Say).

Augusta, Clarke, Essex, Fairfax, Loudoun, Louisa, Roanoke, Warren. Host: *Rubus*.

#### Tenthredininae

Larvae of all species are external leaf feeders. Host plants are poorly known for members of this subfamily. See Smith (1991) for flight records for 28 species of *Macrophya*. *Tenthredo* is the large remaining group that needs study; there are no keys to species that occur in Virginia. Literature that is helpful for other groups is as follows: *Aglaostigma* (Ross, 1943a); *Macrophya* (Gibson, 1980); and *Lagium* (Smith, 1986a, 1994b). Goulet & Smith (1993) described several species of *Tenthredo* from eastern United States.

*Aglaostigma quattuordecimpunctatum* (Norton).

Augusta, Grayson, Smyth. Host: *Podophyllum peltatum* L.

*Aglaostigma semiluteum* (Norton).

Arlington, Clarke, Essex, Fairfax, Frederick, Grayson, City of James, Loudoun, Louisa, Montgomery, Page, Smyth, Warren, Washington. Host: *Impatiens capensis* Meerb.

*Lagium atrovioleaceum* (Norton).

Albemarle, Arlington, City of Chesapeake, Clarke, Essex, Fairfax, Giles, Henrico, Loudoun, Louisa, Madison, Montgomery, Nelson, Patrick, Rockingham, Washington. Host: *Sambucus*.

*Leucopelmonus annulicornis* (Harrington).

Augusta, Clarke, Fairfax, Giles, Grayson, Lee, Madison, Smyth.

*Macrophya alba* MacGillivray.

Clarke, Fairfax, Loudoun, Louisa, Montgomery, Rockingham, Smyth, Warren.

*Macrophya albomaculata* (Norton).

Arlington, Carroll, Clarke, Essex, Fairfax, Grayson, Loudoun, Louisa, Rockingham, Warren. Host: *Sambucus*.

*Macrophya bifasciata* (Say).

Clarke, Essex, Giles, Loudoun, Louisa, Montgomery, Tazewell.

*Macrophya cassandra* Kirby.

Arlington, Augusta, Clarke, Essex, Fairfax, Giles, Hanover, Loudoun, Louisa, Montgomery, Rockbridge, Warren. Host: *Carya*.

*Macrophya cinctula* (Norton).

Arlington, Campbell, City of Chesapeake, Essex, Fairfax, Giles, Loudoun, Louisa.

*Macrophya epinota* (Say).

Clarke, Essex, Fairfax, Grayson, Louisa, Montgomery, Rockingham. Host: *Sambucus*.

*Macrophya externa* (Say).

Fairfax, Louisa.

*Macrophya flavicoxae* (Norton).

Arlington, Clarke, Essex, Fairfax, Floyd, Giles, Grayson, Greenville, Loudoun, Louisa, Montgomery, Rockingham, Smyth, Washington.

*Macrophya flavolineata* (Norton).

Clarke, Essex, Fairfax, Giles, Loudoun, Louisa, Montgomery, Russell, Smyth, Warren.

*Macrophya flicta* MacGillivray.

Arlington, Augusta, Clarke, Essex, Fairfax, Giles, Loudoun, Louisa, Montgomery, Rockingham.  
Host: *Prunus*.

*Macrophya formosa* (Klug).

Arlington, Augusta, Clarke, Craig, Essex, Fairfax, Giles, Grayson, Loudoun, Louisa, Montgomery, Page, Rockingham, Warren.

*Macrophya fuliginea* Norton.

Essex, Fairfax, Giles, Louisa. Host: *Castanea*.

*Macrophya goniphora* (Say).

Arlington, Augusta, City of Chesapeake, Clarke, Essex, Fairfax, Giles, Loudoun, Louisa, Montgomery, Rockingham.

*Macrophya lineatana* Rohwer.

Arlington, Clarke, Essex, Fairfax, Loudoun, Louisa.

*Macrophya macgillivrayi* Gibson.

Arlington, Bath, Clarke, Essex, Fairfax, Giles, Loudoun, Louisa, Montgomery, Rockingham, Russell, Warren.

*Macrophya maculilabris* Konow.

Arlington, Clarke, Fairfax, Floyd, Louisa, Montgomery, Rockingham. Host: *Sambucus*.

*Macrophya masneri* Gibson.

Clarke, Loudoun, Rockingham.

*Macrophya masoni* Gibson.

Augusta, Fairfax, Giles, Louisa.

*Macrophya mensa* Gibson.

Augusta, Clarke, Essex, Fairfax, Giles, Loudoun, Louisa, Stafford.

*Macrophya mixta* MacGillivray.

Giles, Louisa. Host: *Viburnum*.

*Macrophya nigra* (Norton).

Augusta, Bath, Essex, Fairfax, Grayson, Lee, Loudoun, Louisa, Rockingham. Host: *Chelone*. See Stamp (1984).

*Macrophya nigristigma* Rohwer.

Arlington, Clarke, Fairfax, Louisa. Host: *Carya*.

*Macrophya nirvana* Gibson.

Rockingham.

*Macrophya pannosa* (Say).

Clarke, Essex, Fairfax, Greene, Loudoun, Louisa, Montgomery, Patrick, Smyth, Tazewell. Host: *Sambucus*.

*Macrophya phylacida* Gibson.

Carroll, Clarke, Essex, Fairfax, Loudoun, Smyth, Tazewell.

*Macrophya pulchella* (Klug).

Arlington, Augusta, Clarke, Essex, Fairfax, Floyd, Giles, Loudoun, Louisa, Montgomery, Warren.

*Macrophya punctata* MacGillivray.

Clarke, Fairfax, Loudoun. Host: *Sambucus*.

*Macrophya senacca* Gibson.

Clarke, Essex, Fairfax, Loudoun, Louisa.

*Macrophya serratalineata* Gibson.

Giles.

*Macrophya simillima* Rohwer.

Clarke, Carroll, Fairfax, Loudoun, Rockingham. Host: *Rudbeckia*.

*Macrophya succincta* Cresson.

Clarke, Loudoun, Montgomery.

*Macrophya tibiator* Norton.

Arlington, Augusta, Fairfax, Loudoun, Louisa, Montgomery.

*Macrophya trisyllaba* (Norton).

Arlington, Clarke, Essex, Fairfax, Giles, Grayson, Loudoun, Louisa, Montgomery, Page, City of Richmond, Rockingham, Warren. Host: *Sambucus*.

*Macrophya varia* (Norton).

Augusta, Clarke, Essex, Fairfax, Giles, Loudoun, Louisa.

*Macrophya zoe* Kirby.

Clarke, Fairfax, Louisa, Warren, Washington.

*Pachyprotasis rapae* (Linnaeus).

Grayson, Smyth. Hosts: *Antirrhinum*, *Betonica*, *Fraxinus*, *Scrophularia*, *Solidago*.

*Tenthredo angulifera* (Norton).

Arlington, Grayson, Montgomery, Page.

*Tenthredo basilaris* Say.  
Giles, Page, Washington.

*Tenthredo carolina* (Rohwer).  
Clarke, Essex, Fairfax, Wise.

*Tenthredo fernowi* Goulet & Smith.  
Augusta, Clarke, Fairfax, Giles, Loudoun, Shenandoah,  
Warren.

*Tenthredo fisheri* (Rohwer).  
Arlington, Clarke, Fairfax, Rockingham, Smyth.

*Tenthredo grandis* (Norton).  
Arlington, Clarke, Essex, Fairfax, Louisa, Page,  
Warren. Host: *Chelone glabra* L. See Stamp (1984).

*Tenthredo leucostoma* Kirby.  
Giles, Grayson, Rockingham.

*Tenthredo lobata* (Norton).  
Augusta, Page, Rockingham.

*Tenthredo mantha* Ross.  
Fairfax, Pulaski, Rockingham.

*Tenthredo masneri* Goulet & Smith.  
Giles, Grayson, Stony Man Mountain [on Madison-  
Page county line].

*Tenthredo mellicoxa* Provancher.  
Clarke, Fairfax, Loudoun, Warren.

*Tenthredo nimbiopennis* Cresson.  
Clarke, Rockingham.

*Tenthredo piceocincta* (Norton) (?).  
Page. Identity uncertain.

*Tenthredo prosopa* Stannard.  
Giles.

*Tenthredo rufopecta* (Norton).  
Arlington, Augusta, Clarke, Essex, Fairfax, Fauquier,  
Giles, Grayson, Loudoun, Louisa, Montgomery, Page,  
Rockingham, Warren.

*Tenthredo rurigena* MacGillivray.  
Clarke, Giles, Louisa.

*Tenthredo secunda* MacGillivray.  
Giles, Grayson.

*Tenthredo verticalis* Say.  
Arlington, Clarke, Essex, Fairfax, Giles, Grayson,  
Loudoun, Louisa, Rockingham.

*Tenthredo yuasi* MacGillivray.  
Clarke, Loudoun, Louisa.

## SIRICIDAE

Larvae are wood borers. Some are easily transported by commerce in lumber outside their native ranges (e.g., the record of *S. longicauda*). Other species also could be found emerging from construction wood imported from the West. Smith & Schiff (2002) treated the species for eastern United States.

*Eriotremex formosanus* (Matsumura).  
Northampton, City of Virginia Beach. Hosts: *Quercus* preferred, also *Carya*, *Liquidambar*. Introduced. See Smith (1996). These are the northernmost records for this species in the United States.

*Sirex areolatus* (Cresson).  
City of Virginia Beach (Cape Henry). Hosts: *Cupressus* sp., *Juniperus* spp., *Libocedrus*, *Pinus*, *Pseudotsuga*, *Sequoia*, *Taxodium*, *Thuja*.

*Sirex edwardsii* Brullé.  
Essex, Fairfax, Montgomery, City of Virginia Beach. Hosts: *Pinus echinata* Mill., *P. elliotii* Engelm., *P. palustris* Mill., *P. rigida* Mill., *P. strobus* L., *P. virginiana* Mill. Also recorded from *Picea*.

*Sirex longicauda* Middlekauff.  
Campbell (Lynchburg). A western species, probably imported in building materials (Smith & Schiff, 2002). Hosts: *Abies*, *Pinus*, *Pseudotsuga*.

*Sirex nigricornis* Fabricius.  
Essex, Fairfax, Montgomery, City of Norfolk, Page, City of Richmond, City of Virginia Beach. Hosts: *Pinus clausa* (Chapm. ex Engelm.) Vasey ex Sarg., *P. echinata* Mill., *P. palustris* Mill., *P. rigida* Mill., *P. strobus* L., *P. taeda* L., *P. virginiana* Mill. Also recorded from *Picea*.

*Tremex columba* (Linnaeus). Pigeon tremex.  
Appomattox, Arlington, Augusta, Bedford, Clarke, Essex, Fairfax, Frederick, Giles, Hanover, Louisa, Loudoun, Montgomery, City of Norfolk, Nottoway, City of Richmond, Roanoke, Smyth, Warren, Washington. Hosts: *Acer*, *Carpinus*, *Carya*, *Celtis*, *Fagus*, *Malus*, *Platanus*, *Pyrus*, *Quercus*, *Ulmus*.

*Urocerus albicornis* (Fabricius).  
Arlington, Montgomery, Washington. Hosts: *Abies*,  
*Larix*, *Picea*, *Pinus*, *Pseudotsuga*, *Thuja*, *Tsuga*.

*Urocerus cressoni* Norton.  
Essex, Fairfax, Montgomery. Hosts: *Abies*, *Picea*,  
*Pinus rigida* Mill., *P. taeda* L.

*Urocerus taxodii* (Ashmead).  
Essex, City of Virginia Beach. Host: *Taxodium*  
*distichum* (L.) Rich.

America.

*Orussus minutus* Middlekauff.  
Clarke, Essex, Fairfax, Louisa, Warren.

*Orussus sayii* (Westwood).  
Essex

*Orussus terminalis* (Newman).  
Clarke, Essex.

### XIPHYDRIIDAE

Larvae are wood borers in small limbs of their host plants. Smith (1976b) revised this family for North America.

*Xiphydria abdominalis* Say.  
Louisa. Host: *Tilia americana* L.

*Xiphydria canadensis* Provancher.  
City of Virginia Beach (June 24, 1915).

*Xiphydria champlaini* Rohwer.  
Fairfax. Host: *Carpinus caroliniana* Walt.

*Xiphydria maculata* Say.  
Augusta, City of Chesapeake, Clarke, Essex, Fairfax,  
Giles, Loudoun, Louisa, City of Newport News, Page.  
Hosts: *Acer*, also recorded from *Tilia* and *Malus*.

*Xiphydria mellipes* Harris.  
Arlington, Grayson, Madison, Roanoke. Host: *Betula*.

*Xiphydria polia* Smith.  
Fairfax, Montgomery.

*Xiphydria scafa* Smith.  
Arlington, Fairfax, Louisa. Host: *Carpinus americana*  
Walt.

*Xiphydria tibialis* Say.  
Clarke, Essex, Fairfax, Loudoun, Louisa. Hosts: *Ulmus*  
*americana*, also recorded from *Acer*, *Betula*, *Crataegus*,  
*Fagus*, *Fraxinus*, *Prunus*, *Quercus*, *Rhus*, *Tilia*.

### ORUSSIDAE

Larvae are parasitoids of wood-boring Coleoptera. Middlekauff (1983) revised this family for North

### CEPHIDAE

Larvae of *Cephus* and *Trachelus* are stem borers in grasses; those of *Hartigia* and *Janus* are stem or twig borers in their host plants. *Hartigia* was revised by Smith (1986b) and Smith & Solomon (1989) provided a key to species of *Janus*.

*Cephus pygmaeus* (Linnaeus).  
European wheat stem sawfly. Clarke, Essex, Giles.  
Hosts: Cultivated grasses such as wheat and, to a lesser extent, barley and rye. *Bromus secalinus* L., *Hordeum vulgare* L., *Secale cereale* L., *Triticum aestivum* L.

*Hartigia bicincta* (Provancher).  
Louisa.

*Hartigia trimaculata* (Say).  
Arlington, Clarke, Essex, Fairfax, Loudoun, Louisa,  
Montgomery, Scott. Hosts: *Rosa*, *Rubus*.

*Janus abbreviatus* (Say). Willow shoot sawfly.  
Clarke, Essex, Fairfax, Louisa. Hosts: *Populus*, *Salix*.

*Janus bimaculatus* (Norton).  
Augusta, Clarke, Essex, Fairfax, Loudoun, Louisa.  
Host: *Viburnum*.

*Janus integer* (Norton). Currant stem girdler.  
Augusta, Clarke, Essex, Fairfax, Loudoun, Louisa,  
Montgomery. Host: *Ribes*.

*Janus quercusae* Smith.  
Essex, Louisa. Host: *Quercus*.

*Trachelus tabidus* (Fabricius). Black grain stem sawfly.  
Arlington, Fairfax, Fauquier, Mecklenburg, Montgomery, Rockingham. Introduced. Hosts: Cultivated grasses such as wheat, barley, rye, oats. No wild grass hosts known in North America. *Avena*, *Hordeum vulgare* L., *Secale cereale* L., *Triticum aestivum* L.

## POTENTIAL SPECIES

Following is a list of species for which I have not seen Virginia records but are likely to occur in the state. The list is undoubtedly incomplete and other species are likely to extend either south or north to Virginia.

## PAMPILIIDAE

*Acantholyda angulata* (MacGillivray).  
Southeastern Canada south to North Carolina, Georgia.  
Host: *Pinus*.

*Acantholyda erythrocephala* (Linnaeus).  
Pine false webworm. Northeastern states to Pennsylvania. Hosts: Various *Pinus*.

*Acantholyda ruficeps* (Harrington).  
Quebec south to North Carolina. Host: *Pinus*.

*Acantholyda poepigii* (Brischke & Zaddach).  
Pennsylvania, North Carolina, Georgia.

*Pamphilius nigriritibialis* Rohwer.  
Quebec to North Carolina.

## DIPRIONIDAE

*Neodiprion sertifer* (Geoffroy).  
European pine sawfly. Introduced. Known in the northeastern states south to Pennsylvania. Host: *Pinus*. I have not seen specimens from Virginia; identities of this species on certain websites reporting it from Virginia need confirmation.

## TENTHREDINIDAE

## Nematinae

*Caulocampus acericaulis* (MacGillivray).  
Maple petiole borer. Northeastern states south to Maryland, West Virginia. Host: *Acer*.

*Hemichroa crocea* (Geoffroy).  
Striped alder sawfly. This species has been taken in New York and Pennsylvania and in the mountains of North Carolina. Host: *Alnus*.

*Hoplocampa brevis* (Klug).  
Northeastern states south to Maryland. Host: *Pyrus*, larvae feed in developing fruit or pears.

*Hoplocampa testudinea* (Hartig).

European apple sawfly. Introduced. Northeastern states, and has been taken in Montgomery Co., Maryland (Smith, 2003). Host: *Malus*. Larvae feed in developing fruits.

*Pikonema dimmockii* (Cresson).

Greenheaded spruce sawfly. Known in the northeastern states and in the mountains of North Carolina.

*Pristiphora rufipes* (Serville).

Introduced. Northeastern states south to West Virginia. Host: *Aquilegia*. In previous literature as *Pristiphora aquilegiae* (Vollenhoven).

## Heterarthrinae

*Fenella nigrita* Westwood.

Northeastern states south to West Virginia. Hosts: *Agrimonia*, *Potentilla*. A leafminer.

*Fenusa dohrnii* (Tischbein).

European alder leafminer. Host: *Alnus*. Has been found as far south as Garrett Co., Maryland.

*Fenusa pusilla* (Lepeletier).

Birch leafminer. Host: *Betula*. Has been taken on ornamental birch in Silver Spring, Maryland.

## Blennocampinae

*Monophadnoides quebecensis* Smith.

Known from Quebec, West Virginia, and the mountains of North Carolina.

*Stethomostus fuliginosus* (Schrank).

Northeastern, south to Maryland. Host: *Ranunculus*.

## Allantinae

*Dimorphopteryx abnormis* Rohwer.

Occurs in nearby West Virginia.  
Hosts: *Amelanchier*, *Crataegus*, *Prunus*, *Pyrus*.

## Tenthredininae

*Macrophya propinqua* Harrington.

Northeastern; occurs in nearby West Virginia.

*Tenthredo appalachia* Goulet & Smith.

Recorded from nearby West Virginia.

*Tenthredo mellina* (Norton).

Recorded from Maryland.

*Tenthredo semirufa* Norton.  
New Hampshire south to North Carolina.

*Tenthredo subcoerulea* Eschscholtz.  
Quebec to Florida.

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#### LITERATURE CITED

- Ahlstrom, K. R. 1995. Insects of North Carolina, Fourth Supplement. Part I: Hymenoptera. North Carolina Department of Agriculture, Plant Industry Division, Raleigh. 147 pp.
- Ashmead, W. H. 1890. On the Hymenoptera of Colorado: Descriptions of new species, notes, and a list of the species found in the state. Colorado Biological Association Bulletin No. 1. 46 pp.
- Bobb, M. L. 1963. Insect parasites of the Virginia pine sawfly, *Neodiprion pratti pratti*. Journal of Economic Entomology 56: 618-621.
- Bobb, M. L. 1965. Insect parasite and predator studies in a declining sawfly population. Journal of Economic Entomology 58: 925-926.
- Boyd, D., Jr. 2005. Beating the hibiscus sawfly. American Nurseryman, Feb. 15, 2005, pp. 22-25.
- Bradley, J. C. 1928. Tenthredinoidea. Pp. 870-895 In M. D. Leonard (ed.), A list of the insects of New York, with a list of spiders and certain other allied groups. Cornell University, Agriculture Experiment Station Memoir 101. 1,121 pp.
- Braud, R., D. R. Smith, J. S. Strazanac, & L. Butler. 2003. Diversity, abundance, and seasonality of adult and larval Symphyta (Hymenoptera) in the George Washington National Forest, Virginia, and the Monongahela National Forest, West Virginia. Proceedings of the Entomological Society of Washington 105: 756-768.
- Brimley, C. S. 1938. The Insects of North Carolina. North Carolina Department of Agriculture, Division of Entomology, Raleigh. 560 pp.
- Burdick, D. J. 1961. A taxonomic and biological study of the genus *Xyela* Dalman in North America. University of California Publications in Entomology 17: 285-356.
- Chapman, P. J., & G. E. Gould. 1929. Sweet potato sawfly. Virginia Truck Experiment Station Bulletin 68, pp. 769-786.
- Gibson, G. A. P. 1980. A revision of the genus *Macrophya* Dahlbom (Hymenoptera: Symphyta, Tenthredinidae) of North America. Memoirs of the Entomological Society of Canada, No. 114. 167 pp.
- Goulet, H. 1986. The genera and species of the Nearctic Dolerini (Symphyta: Tenthredinidae: Selandriinae): Classification and phylogeny. Memoirs of the Entomological Society of Canada, No. 135. 208 pp.
- Goulet, H. 1992. The genera and subgenera of sawflies of Canada and Alaska. The Insects and Arachnids of Canada. Part 20. Agriculture Canada Publications, Ottawa. 235 pp.
- Goulet, H. 1993. Superfamilies Cephoidea, Megalodontoidea, Orussoidea, Siricoidea, Tenthredinoidea, and Xyeloidea. Pp. 101-129 In H. Goulet & J. T. Huber (eds.), Hymenoptera of the World: An Identification Guide to Families. Research Branch, Agriculture Canada Publication 1894/E, Ottawa. 668 pp.

- Goulet, H., & D. R. Smith. 1995. Four new sawflies from eastern North America, three species of *Tenthredo* and one of *Dolerus* (Hymenoptera: Tenthredinidae). *Proceedings of the Entomological Society of Washington* 97: 50-62.
- Hetrick, L. A. 1941. Life history studies of *Neodiprion americanum* (Leach). *Journal of Economic Entomology* 34: 373-377.
- Hetrick, L. A. 1956. Life history studies of five species of *Neodiprion* sawflies. *Forest Science* 2: 181-185.
- Hetrick, L. A. 1959. Ecology of the pine sawfly, *Neodiprion excitans* (Rohwer) (Hymenoptera: Diprionidae). *Florida Entomologist* 42: 159-162.
- MacGillivray, A. D. 1910. Phytophaga. Pp. 580-595 *In* J. B. Smith (ed.), *Insects of New Jersey*. Annual Report of the New Jersey State Museum. Including a Report of the Insects of New Jersey, 1909. Trenton, NJ. 880 pp.
- MacGillivray, A. D. 1916. Tenthredinoidea. Pp. 25-175 *In* H. L. Viereck (ed.), *Guide to the Insects of Connecticut, Part 3, The Hymenoptera, or Wasp-Like Insects of Connecticut*. Connecticut Geological and Natural History Survey Bulletin 22.
- Middlekauff, W. W. 1958. The North American sawflies of the genera *Acantholyda*, *Cephalcia*, and *Neurotoma* (Hymenoptera: Pamphiliidae). University of California Publications in Entomology 14: 51-174.
- Middlekauff, W. W. 1964. The North American sawflies of the genus *Pamphilius* (Hymenoptera: Pamphiliidae). University of California Publications in Entomology 38: 1-80.
- Middlekauff, W. W. 1983. A revision of the sawfly family Orussidae for North and Central America (Hymenoptera: Symphyta, Orussidae). University of California Publications in Entomology 101: 1-46.
- Morris, C. L., W. J. Schroeder, & M. L. Bobb. 1963. A pine sawfly *Neodiprion pratti pratti* (Dyar) in Virginia. Virginia Division of Forestry, Department of Conservation and Economic Development. 42 pp.
- Ross, H. H. 1937. A generic classification of the Nearctic sawflies (Hymenoptera: Symphyta). *Illinois Biological Monographs* 15. 173 pp.
- Ross, H. H. 1943a. The Nearctic sawflies of the genus *Aglao stigma* (Hymenoptera). *Proceedings of the Entomological Society of Washington* 45: 79-84.
- Ross, H. H. 1943b. The North American species of the genus *Hoplocampa* (Hymenoptera: Tenthredinidae). *Transactions of the American Entomological Society* 69: 61-92.
- Ross, H. H. 1945. A taxonomic outline of the Nearctic species of *Pachynematus* (Tenthredinidae, Hymenoptera). *Proceedings of the Entomological Society of Washington* 47: 105-120.
- Ross, H. H. 1955. The taxonomy and evolution of the sawfly genus *Neodiprion*. *Forest Science* 1: 196-209.
- Smith, D. R. 1966. Recognition of the European apple sawfly and the pear sawfly (Hymenoptera: Tenthredinidae). *Cooperative Economic Insect Report* 16: 228-230.
- Smith, D. R. 1968. The genus *Caulocampus* Rohwer (Hymenoptera: Tenthredinidae). *Proceedings of the Entomological Society of Washington* 70: 126-129.
- Smith, D. R. 1969a. The genus *Craterocercus* Rohwer (Hymenoptera: Tenthredinidae). *Proceedings of the Entomological Society of Washington* 71: 153-161.
- Smith, D. R. 1969b. Nearctic sawflies I: Blennocampinae: Adults and larvae (Hymenoptera: Tenthredinidae). U.S. Department of Agriculture Technical Bulletin No. 1397. 176 pp., 19 pls.
- Smith, D. R. 1969c. Nearctic sawflies II: Selandriinae: Adults (Hymenoptera: Tenthredinidae). U.S. Department of Agriculture Technical Bulletin No. 1398. 48 pp., 10 pls.
- Smith, D. R. 1969d. Key to genera of Nearctic Argidae (Hymenoptera) with revisions of the genera *Atomacera* Say and *Sterictiphora* Billberg. *Transactions of the American Entomological Society* 95: 439-457.
- Smith, D. R. 1970. A new Nearctic *Xyela* causing galls on *Pinus* spp. (Hymenoptera: Xyelidae). *Journal of the Georgia Entomological Society* 5: 69-72.
- Smith, D. R. 1971a. Nearctic sawflies III: Heterarthrinae: Adults and larvae (Hymenoptera:

- Tenthredinidae). U.S. Department of Agriculture Technical Bulletin No. 1420. 84 pp., 18 pls.
- Smith, D. R. 1971b. Nearctic sawflies of the genera *Neoptilia* Ashmead, *Schizocerella* Forsius, *Aprosthem* Konow, and *Sphacophilus* Provancher (Hymenoptera: Argidae). Transactions of the American Entomological Society 97: 537-594.
- Smith, D. R. 1972. Sawflies of the genus *Croesus* Leach in North America (Hymenoptera: Tenthredinidae). Proceedings of the Entomological Society of Washington 74: 169-180.
- Smith, D. R. 1974. Sawflies of the tribe Cladiini in North America (Hymenoptera: Tenthredinidae: Nematinae). Transactions of the American Entomological Society 100: 1-28.
- Smith, D. R. 1975a. A rose sawfly new to North America (Hymenoptera: Tenthredinidae). Cooperative Economic Insect Report 25: 163-165.
- Smith, D. R. 1975b. The sawfly genus *Hemichroa* Stephens: A review of species (Hymenoptera: Tenthredinidae). Entomologica Scandinavica 6: 297-302.
- Smith, D. R. 1976a. Sawflies of the tribe Pseudodineurini in North America (Hymenoptera: Tenthredinidae). Proceedings of the Entomological Society of Washington 78: 67-79.
- Smith, D. R. 1976b. The xiphydriid woodwasps of North America (Hymenoptera: Xiphydriidae). Transactions of the American Entomological Society 102: 101-131.
- Smith, D. R. 1979a. Symphyta. Pp. 1-137 In K. V. Krombein, P. D. Hurd, Jr., D. R. Smith, & B. D. Burks (eds.), Catalog of Hymenoptera in America North of Mexico, Vol. 1, Symphyta and Apocrita (Parasitica). Smithsonian Institution Press, Washington, DC. xvi + 1,198 pp.
- Smith, D. R. 1979b. Nearctic sawflies IV: Allantinae: Adults and larvae (Hymenoptera: Tenthredinidae). U.S. Department of Agriculture Technical Bulletin 1595. 172 pp., 24 pls.
- Smith, D. R. 1986a. Review of the sawfly genus *Lagium* (Hymenoptera: Tenthredinidae). Proceedings of the Entomological Society of Washington 88: 179-184.
- Smith, D. R. 1986b. The berry and rose stem-borers of the genus *Hartigia* in North America (Hymenoptera: Cephidae). Transactions of the American Entomological Society 112: 129-156.
- Smith, D. R. 1989. The sawfly genus *Arge* (Hymenoptera: Argidae) in the Western Hemisphere. Transactions of the American Entomological Society 115: 83-205.
- Smith, D. R. 1991. Flight records for twenty-eight species of *Macrophya* Dahlbom (Hymenoptera: Tenthredinidae) in Virginia, and an unusual specimen of *M. epinota* (Say). Proceedings of the Entomological Society of Washington 93: 772-775.
- Smith, D. R. 1994a. *Nepionema*, a nematine sawfly genus new to North America, and an unusual new species of *Nematus* (Hymenoptera: Tenthredinidae). Proceedings of the Entomological Society of Washington 96: 133-138.
- Smith, D. R. 1994b. The larva of *Lagium atrovioleaceum* (Norton) (Hymenoptera: Tenthredinidae). Proceedings of the Entomological Society of Washington 96: 139-142.
- Smith, D. R. 1995. The elm leafminer, *Kaliofenusa ulmi* (Sundevall) (Hymenoptera: Tenthredinidae) in Virginia, and summary of host records. Banisteria 5: 39-41.
- Smith, D. R. 1996. Discovery and spread of the Asian hornail, *Eriotremex formosanus* (Matsumura) (Hymenoptera: Siricidae), in the United States. Journal of Entomological Science 31: 166-171.
- Smith, D. R. 2003. Expanding ranges for four species of invasive sawflies (Hymenoptera: Tenthredinidae) in eastern United States. Proceedings of the Entomological Society of Washington 105: 246-248.
- Smith, D. R., & E. M. Barrows. 1987. Sawflies (Hymenoptera: Symphyta) in urban environments in the Washington, D.C. area. Proceedings of the Entomological Society of Washington 89: 147-156.
- Smith, D. R., & N. M. Schiff. 1998. The genera *Macroxyela* Kirby and *Megaxyela* Ashmead (Hymenoptera: Xyelidae) in North America. Proceedings of the Entomological Society of Washington 100: 636-657.



Smith, D. R., & N. M. Schiff. 2002. A review of the siricid woodwasps and their ibaliid parasitoids (Hymenoptera: Siricidae, Ibaliidae) in the mid-Atlantic region. *Proceedings of the Entomological Society of Washington* 104: 174-194.

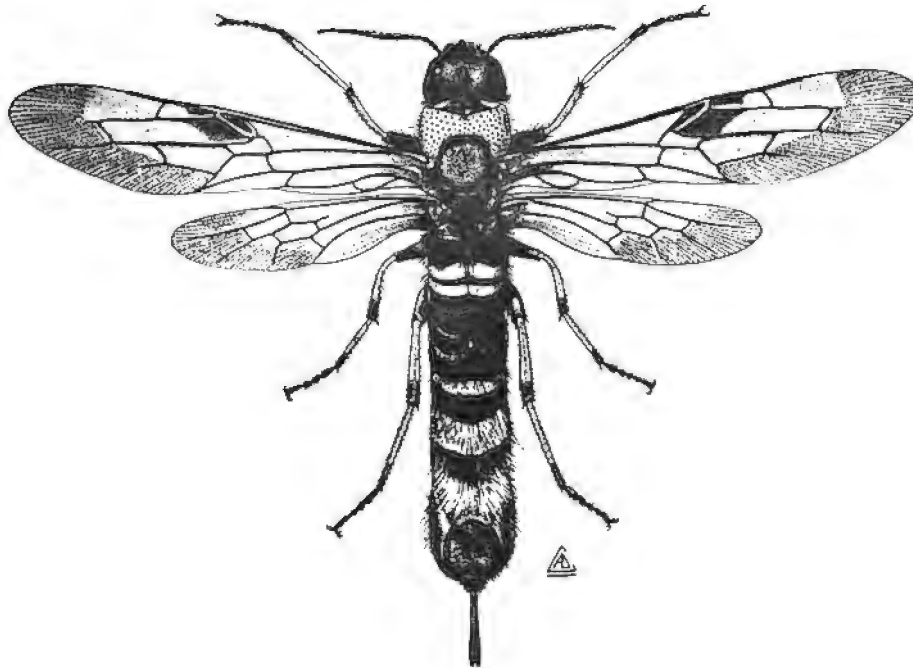
Smith, D. R., & J. D. Solomon. 1989. A new *Janus* (Hymenoptera: Cephidae) from *Quercus*, and a key to North American species. *Entomological News* 100: 1-5.

Stamp, N. E. 1984. Effect of defoliation by checkerspot caterpillars (*Euphydryas phaeton*) and sawfly larvae (*Macrophya nigra* and *Tenthredo grandis*) on their host

plants (*Chelone* spp.). *Oecologia* 63: 275-280.

Strazanac, J.S., D. R. Smith, R. A. Braud, C. J. Fritzler, & L. Butler. 2003. Symphyta (Hymenoptera) species richness in mixed oak-pine forests in the central Appalachians. *Proceedings of the Entomological Society of Washington* 105: 131-137.

Thomas, H. H., J. H. Ghent, & C. G. Stone. 1982. Use of pheromone traps as a new technique in a large-scale survey of the introduced pine sawfly (Hymenoptera: Diprionidae). *Bulletin of the Entomological Society of America* 28: 303-304.



## Bird Records from the Southwestern Virginia Roanoke Sewage Treatment Plant

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Roanoke, Virginia 24019

### ABSTRACT

The Roanoke Sewage Treatment Plant serves as a principal stopover site in southwestern Virginia for migrating birds, especially shorebirds, ducks, and long-legged waders. An annotated list of 242 species of transient and resident birds that have been documented at the facility is provided.

*Key words:* birds, sewage treatment plant, shorebirds, Virginia.

### INTRODUCTION

The Roanoke Water Pollution Control Plant, or Sewage Treatment Plant (STP), is a modern advanced waste treatment facility that serves the town of Vinton, the cities of Roanoke and Salem, and Botetourt and Roanoke counties in southwestern Virginia. This facility was built in 1951 and occupies a 24 ha tract of land, with diverse habitat composed of forest edge, grassy hillsides, access roads, and two large, open, 22 and 30 million gallon capacity concrete basins, or holding ponds, for the city's rainwater. These basins periodically fill with water, serving as an attractant to numerous ducks, swallows, and gulls. Additionally, there are five sludge lagoons with pools of liquid and semi-liquid effluent forming extensive sludge-flats, similar to coastal mud flats and tidal pools. Elevated dikes serve as roads around the lagoons, providing excellent, unobstructed viewing platforms across the lagoons and above the Roanoke River. Adjacent off-site residential housing, a recreational ball field, and several gravel parking lots contribute additional habitat diversity to the area. The Roanoke River forms a boundary to the north at the confluence of Tinker Creek. The wooded riparian edge is dominated by Boxelder (*Acer negundo*), Silver Maple (*Acer saccharinum*), Siberian Elm (*Ulmus pumila*), Pawpaw (*Asimina triloba*), and Sycamore (*Plantanus occidentalis*). This facility offers birdwatchers unrestricted access to a major part of the property.

Since its installation, STP has served as a principal

stopover site for migrating birds, especially shorebirds, ducks, and long-legged waders. These species are usually associated with more tidal and estuarine habitats found along the Atlantic coast, 320 km eastward. During a mid-1970s Christmas Bird Count, a member of the Roanoke Bird Club discovered STP as a refuge for birds. Since then, STP, with its ease of access and excellent vantage points, has served as a popular destination for birdwatchers.

Nationally, sewage treatment facilities are well known in the birding community as important bird habitats, particularly as feeding and staging sites for migratory species. DeCecco & Cooper (1996) studied shorebird migration at a Mississippi River wastewater treatment plant over a 13-year period. Keller (1992) quantified the various species of shorebirds that visit an Indianapolis sewage disposal plant. The research of Fuller & Glue (1980) in Great Britain shows that modern sewage treatment facilities vary greatly in their potential value as bird habitats, and bird communities within these facilities differ not only between various treatment methods, but also between components that make up sewage treatment systems. As is true of Roanoke's STP, these treatment facilities have proven that they are used by a variety of breeding, migrant, and wintering species.

Middleton's (1982) paper entitled "Fame Comes to Roanoke's "STP" as Stopover for Transients" gives an overview of Roanoke's sewage treatment facility and a number of bird species that were documented there until the early 1980s. This work includes an annotated

list of only 27 species of shorebirds documented to that point. The purpose of this paper is to document the entire known avifauna of the Roanoke Sewage Treatment Plant. Unlike other branches of natural history such as botany, entomology, geology, and herpetology, where specimens are collected or vouchered to substantiate occurrences for a site, bird observations, rare or otherwise, are generally accepted from reputable and skilled observers. This annotated list is the result of reports from numerous birdwatchers of the Roanoke, Botetourt, Lynchburg, and Blacksburg areas that document the seasonal occurrences of these birds. Birds were identified, often with the aid of binoculars and spotting scopes, on the basis of characteristic field marks and behaviors as described in standard references, including Robbins et al. (1966) and Peterson (1980). No bird capture methods (e.g., mist nets) were used to aid in identification. These sightings are the result of intense searches and incidental findings spanning the past quarter century.

#### SPECIES ACCOUNTS

Bird life at STP is diverse; 62% of the avian species documented for Virginia have been observed at the site, including a number of rare species. The following annotated list includes records for 242 species of birds that have been documented at STP. Within the STP property, the riparian habitat, brushy thickets, and a stand of mixed hardwoods and conifers offers nesting habitat for at least 65 species of birds; however, no study of the nesting birds has been conducted. Species documented as breeding at STP are denoted with an asterisk (\*). For the purposes of this report, breeding evidence is defined as birds observed in copulation, eggs or young in nest, and adults carrying nest material, food, or fecal sacs. Undocumented but suspected breeders are denoted with a plus sign (+). The list also includes four non-native species, Rock Pigeon (*Columba livia*), European Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), and House Finch (*Carpodacus mexicanus*), that have established reproducing populations in Virginia. Several additional exotic or escaped cage bird species that have been documented at STP are included at the end of the annotation. The list follows AOU (2003) scientific and English nomenclature and species sequence. Most of the peak count dates cited are taken from Kinzie (1985) and Kain (1987). Values in parentheses refer to the number of individuals observed on a particular date. All records are given for rare species and only selected dates for more regular or common species.

#### ANNOTATED CHECKLIST

##### *Dendrocygna bicolor* (Fulvous Whistling-Duck)

One record: 29 May - 2 July 1979 (1) (Kinzie, 1985).

##### *Chen caerulescens* (Snow Goose)

One record: 1 April 1993 (2).

##### \* *Branta canadensis* (Canada Goose)

Common permanent resident. Records include 31 March 1982 (2), 25-27 November 1987 (1), 5 March 1992 (1), and 25 May 2001 (2 adults, 4 young). Peak count: 44 (28 December 1990).

##### *Cygnus columbianus* (Tundra Swan)

Three records: 25 March 1984 (1), 18 March 1992 (1), and 13 November 1997 (1).

##### \* *Aix sponsa* (Wood Duck)

Records include 17 March 1987 (5), 26 May 1983 (1 adult, 14 young), 27 February 1991 (2), and 14 October 1995 (6).

##### *Anas strepera* (Gadwall)

Records include 28 February 1980 (1), 10 November 1990 (1), and 11 November 1995 (2).

##### *Anas americana* (American Wigeon)

Records include 3 January 1985 (1), 17 March 1987 (3), 2 May 1990 (2), and 10 November 1991 (1).

##### *Anas rubripes* (American Black Duck)

Records include 17 March 1991 (4), 15 November 1995 (10), and 16 December 2000 (1). Peak count: 16 (5 January 1991).

##### \* *Anas platyrhynchos* (Mallard)

Records include 25 November 1979 (1), 2 May 1983 (1 adult, 11 young), and 1 February 1997 (8). Peak count: 21 (16 December 2000).

##### *Anas discors* (Blue-winged Teal)

Records include 14 August 1991 (2), 29 March 1984 (16), and 5 October 1995 (2). Peak count: 41 (8 April 1987). A pair observed on 6 July 1979 indicates possible breeding activity.

##### *Anas clypeata* (Northern Shoveler)

Records include 9 March 1980 (1), 4 April 1982 (1), 6 April 1987 (2), 22 September 1992 (1), and 21 April 1993 (1). Peak count: 6 (5 April 1980).

##### *Anas acuta* (Northern Pintail)

Records include 7 September 1981 (1), 21 April 1987

(1), 21 February 1992 (1), and 17 May 1993 (2). One summer record: 15-17 July 1980 (2).

*Anas crecca* (Green-winged Teal)

Records include 20 March 1982 (1) and 3 January 1992 (4). Peak count: 6 (3 November 1995).

*Aythya valisineria* (Canvasback)

One record: 28 November 1982 (2).

*Aythya americana* (Redhead)

One record: 10 November 1991 (1).

*Aythya collaris* (Ring-necked Duck)

Records include 6 March 1983 (1), 6 April 1987 (3), and 18 March 1991 (1). Peak count: 10 (14 March 1991).

*Aythya marila* (Greater Scaup)

Records include 11 November 1981 (1) and 23 November 1992 (1). Peak count: 50 (1 March 1985).

*Aythya affinis* (Lesser Scaup)

Records include 4 April 1984 (13), 24 May 1985 (1), 17 March 1987 (12), and 3 November 1995 (1). Peak count: 64 (21 March 1982).

*Melanitta fusca* (White-winged Scoter)

Three records: 21-31 October 1987 (1), 7 November 1987 (1), and 8 January 1991 (1).

*Clangula hyemalis* (Long-tailed Duck)

One record: 29 March 1984 (2).

*Bucephala albeola* (Bufflehead)

Records include 3 January 1992 (2) and 17 March 1991 (1). Peak count: 8 (4 January 1988).

*Bucephala clangula* (Common Goldeneye)

Records include 21 November 1982 (1), 22 January 1986 (2), and 16-17 January 1991 (1).

*Lophodytes cucullatus* (Hooded Merganser)

Records include 28 May 1991 (1), 9 November 1990 (6), and 5 April 1992 (5). Peak count: 30 (11 January 1981). On 3 June 1983, two immatures were observed, suggesting a local breeding population.

*Mergus serrator* (Red-breasted Merganser)

Records include 24 April 1981 (1), 20 April 1992 (4), and 28 March 1993 (4). Peak count: 13 (29 March 1990).

*Oxyura jamaicensis* (Ruddy Duck)

Records include 21 March 1983 (5), 6 April 1986 (7), 8 October 1988 (1), 24 May 1986 (1), and 3 November 1995 (6). Peak count: 30 (11 January 1981; Kinzie, 1995).

+ *Bonasa umbellus* (Ruffed Grouse)

Only one record of one bird (23 May 1982), although this species probably breeds on STP.

+ *Meleagris gallopavo* (Wild Turkey)

Common permanent resident. Records include 30 November 1983 (4), 30 November 1987 (6), 26 March 1988 (4), and 16 December 2000 (3). Peak count: 7 (12 April 1993).

*Colinus virginianus* (Northern Bobwhite)

Only two records: 15 February 1983 (1) and 5 April 1988 (2). All three birds were observed across the Roanoke River.

*Gavia immer* (Common Loon)

Two records: 17 April 1987 (1) and 28 March 1993 (1).

*Podilymbus podiceps* (Pied-billed Grebe)

Records include 15 October 1995 (2) and 13 April 1996 (1). Peak count: 9 (15 November 1995).

*Podiceps auritus* (Horned Grebe)

Records include 20 March 1982 (1), 16 April 1983 (2), 10 November 1991 (1), and 10 April 1993 (2). Peak count: 11 (28 November 1982).

*Phalacrocorax auritus* (Double-crested Cormorant)

Records include 26 May 1985 (1), 17 April 1989 (1), 7 April 1990 (3), 9 April 1992 (2), and 16 September 1995 (1).

*Botaurus lentiginosus* (American Bittern)

Two records: 17-22 October 1982 (1) and 17-25 April 1986 (1).

*Ixobrychus exilis* (Least Bittern)

Two records: 2 October 1984 (1) and 3 May 1993 (1).

*Ardea herodias* (Great Blue Heron)

Records include 25 June 1987 (1 immature), 8 August 1991 (1), and 19 July 1992 (1). Peak count: 10 (5 November 1984).

*Ardea alba* (Great Egret)

Records include 13 April 1984 (2), 20 October 1987 (2), and 12 August 1995 (1). Peak count: 2 (20 October 1987).

*Egretta thula* (Snowy Egret)

Four records: 18 May 1985 (1), 17 April 1987 (1), 8 May 1988 (1), and 4 June 1992 (1).

*Egretta caerulea* (Little Blue Heron)

Three records: 24 July 1981 (1), 5 April 1983 (1), and 27 July 1991 (1).

*Egretta tricolor* (Tricolored Heron)

One record: 30 July 1989 (1).

*Bubulcus ibis* (Cattle Egret)

Records include 10 October 1982 (1), 14 September 1983 (1), 26 May 1987 (1), and 30 October 1987 (4). Peak count: 5 (1 November 1984).

\* *Butorides virescens* (Green Heron)

Records include 14 April 1980 (2), 17 January 1987 (1), 19 July 1992 (2), 29 August 1992 (2 immature), and 4 November 1995 (1).

*Nycticorax nycticorax* (Black-crowned Night-Heron)

Records include 5 April 1983 (1), 16 April 1985 (2), 9 May 1987 (1 immature), 29 March 1989 (1), and 23 July 1991 (1).

+ *Nyctanassa violacea* (Yellow-crowned Night-Heron)

Records include 8 April 1984 (1), 30 May 1986 (1), 26 May 1987 (1), 30 July 1992 (2 immature), and 19 August 1992 (1). Peak count: 4 (31 July 1989).

*Eudocimus albus* (White Ibis)

One record: 29 July 1980 (2).

*Plegadis falcinellus* (Glossy Ibis)

One record: 3-5 November 1986 (1).

*Coragyps atratus* (Black Vulture)

Uncommon permanent resident. Peak count: 4 (23 January 1988).

*Cathartes aura* (Turkey Vulture)

Common permanent resident. Peak count: 5 (1 January 1984).

*Pandion haliaetus* (Osprey)

Records include 12 April 1980 (1), 29 August 1992 (1), and 6 September 1993 (1), always 1-2 birds.

*Haliaeetus leucocephalus* (Bald Eagle)

Two records: 27 February 1988 (1) and 3 January 1992 (1).

*Circus cyaneus* (Northern Harrier)

Records include 4 September 1990 (1 immature), 7 September 1991 (1), and 26 October 1999 (1), always 1-2 birds.

*Accipiter striatus* (Sharp-shinned Hawk)

Records include 5 February 1982 (1) and 10 January 1992 (1), always 1-2 birds.

*Accipiter cooperii* (Cooper's Hawk)

Records include 8 March 1980 (1), 6 April 1991 (1 immature), 8 February 1994 (1), and 5 November 1995 (1).

*Buteo lineatus* (Red-shouldered Hawk)

Records include 20 February 1983 (1) and 20 May 1992 (1).

\* *Buteo platypterus* (Broad-winged Hawk)

Records include 17 April 1983 (1), 10 April 1993 (1), and 18 April 1996 (4). Peak count: 5 (18 April 1992).

+ *Buteo jamaicensis* (Red-tailed Hawk)

Common permanent resident.

\* *Falco sparverius* (American Kestrel)

Records include 1 January 1985 (1), 18 April 1993 (1), and 7 August 1994 (1).

*Falco columbarius* (Merlin)

Records include 16 October 1986 (1), 18 April 1992 (1), and 3 March 1994 (1).

*Falco peregrinus* (Peregrine Falcon)

Records include 26 October 1982 (1), 1 September 1991 (1), 25 March 1992 (1), 28 August 1992 (1), 22 September 1992 (1), 27 October 1992 (1), and 25 September 1994 (1).

*Porzana carolina* (Sora)

Records include 13-18 September 1983 (1) and 29 April 1987 (1). Never more than one bird observed per date.

*Fulica americana* (American Coot)

Records include 4 November 1982 (1), 24 October 1993 (1), and 7 May 1995 (1). Peak count: 2 (6 April 1983).

*Pluvialis squatarola* (Black-bellied Plover)

Records include 11 November 1979 (1), 14 May 1980 (2), 18 May 1981 (1), 18 August 1985 (1), 10 July 1986 (1), and 23 September 1995 (1). Never more than two birds observed per date.

*Pluvialis dominica* (American Golden-Plover)

Records include 21 September 1981 (2), 10-11 October 1983 (1), 6 September 1988 (2), 19-30 September 1990 (2), 15 November 1992 (1), and 23 September 1995 (1).

*Charadrius semipalmatus* (Semipalmated Plover)

Records include 22 April 1992 (1), 12 May 1981 (1), 17 October 1988 (1), and 17 September 1993 (1). Peak count: 72 (18 May 1981; Kinzie, 1985).

*Charadrius melodus* (Piping Plover)

Four records: 17 August 1978 (1), 29 July-5 August 1979 (1), 2-3 August 1981 (1), and 23-24 June 1990 (1).

\* *Charadrius vociferus* (Killdeer)

Common permanent resident. 11 April 1993 (1 adult with 2 eggs). Peak count: 204 (30 July 1983).

*Recurvirostra americana* (American Avocet)

Five records: 11 October 1975 (1), 25-28 October 1984 (2, with one remaining until 2 November), 5 July 1985 (1), 8 August 1985 (4), and 1 September 1997 (1).

*Tringa melanoleuca* (Greater Yellowlegs)

Records include 19 March 1991 (1), 8 July 1981 (1), 25 April 1987 (1), and 13 October 1995 (1). Peak count: 5 (4 May 1997).

*Tringa flavipes* (Lesser Yellowlegs)

Records include 25 February 1985 (1) and 30 August 1995 (1). Peak count: 77 (28 July 1980; Kinzie, 1985).

*Tringa solitaria* (Solitary Sandpiper)

Records include 8 July 1983 (1), 3 April 1986 (1), 2 July 1987 (1), and 9 October 1992 (1). Peak count: 52 (27 April 1982; Kinzie, 1985).

*Catoptrophorus semipalmatus* (Willet)

Records include 18 May 1987 (1), 2 August 1978 (1), 10 July 1979 (2), and 29 August 1992 (1). Peak count: 15 (11 May 1981; Kinzie, 1985).

+ *Actitis macularia* (Spotted Sandpiper)

Records include 15 April 1991 (2), 23 July 1992 (1), and 5 October 1995 (1). Peak count: 101 (19 May 1981).

*Numenius phaeopus* (Whimbrel)

One record: 14 September 1983 (1).

*Arenaria interpres* (Ruddy Turnstone)

Records include 19 May 1981 (1), 27 July 1985 (1), 3-6 September 1987 (1), 3 June 1988 (1), 23 August 1990

(1), and 4 September 1993 (2).

*Calidris canutus* (Red Knot)

One record: 28-30 July 1980 (1).

*Calidrus alba* (Sanderling)

Records include 20 August 1980 (1), 29-31 May 1983 (1), 14-21 September 1983 (1), 6 August 1988 (2), and 2 October 1991 (3). Peak count: 8 (20 August 1987).

*Calidris pusilla* (Semipalmated Sandpiper)

Records include 8 May 1981 (1), 29 October 1991 (3), and 13 August 1995 (2). Peak count: 259 (3 June 1979; Kain, 1987).

*Calidris mauri* (Western Sandpiper)

Records include 5 September 1992 (1), 2 June 1994 (1), and 12-19 August 1995 (1). Peak count: 5 (24 July 1979).

*Calidris minutilla* (Least Sandpiper)

Records include 27 March 1986 (1), 25 April 1987 (1), and 5 August 1994 (1). Peak count: 398 (12 May 1981; Kain, 1987).

*Calidris fuscicollis* (White-rumped Sandpiper)

Records include 19 May 1981 (5), 1-7 September 1981 (2), 14-21 October 1984 (1), 26 August 1989 (4), and 7-15 November 1990 (1). Peak count: 18 (26 May 1981; Kain, 1987).

*Calidris bairdii* (Baird's Sandpiper)

Records include 17 September 1979 (1), 13-16 September 1983 (1), 26 October 1987 (1), 22-28 August 1988 (1), and 5 September 1995 (1). Spring records include a single bird on 18 and 23 May 1980. Peak count: 5 (6-7 September 1979; Kain, 1987).

*Calidris melanotos* (Pectoral Sandpiper)

Records include 22 July 1980 (1), 11 February 1986 (1), 25 October 1987 (1), 23 October 1992 (2), 1 December 1993 (1), and 5 May 1995 (1). Peak count: 89 (2 October 1985).

*Calidris alpina* (Dunlin)

Records include 18 May 1981 (3), 3 April 1982 (2), 22 October 1982 (2), 4 September 1983 (2), and 5 November 1992 (1). Peak count: 59 (19 May 1991).

*Calidris himantopus* (Stilt Sandpiper)

Records include 28 July 1980 (3), 16 September 1981 (1), 7 August 1982 (1), 4 September 1983 (1), 25 July 1985 (5), 9 September 1988 (11), and 23 July 1992 (1). Peak count: 12 (29 July 1980; Kain, 1987).

*Tryngites subruficollis* (Buff-breasted Sandpiper)

Records include 12 September 1978 (1), 19-30 August 1981 (1), 8-9 September 1984 (1), 18 August 1985 (2), 9 August 1991 (1), and 2 September 1995 (1).

*Limnodromus griseus* (Short-billed Dowitcher)

Records include 1 September 1982 (1), 8 November 1982 (1), and 8 April 1995 (1). Peak count: 33 (18 May 1981).

*Limnodromus scolopaceus* (Long-billed Dowitcher)

Two records: 13-17 October 1983 (1) and 23 September 1984 (1).

*Gallinago delicata* (Wilson's Snipe)

Records include 13 March 1987 (3), 21 January 1991 (1), 6 May 1991 (1), 8 November 1991 (1), 18 April 1992 (4), and 12 September 1997 (1). Peak count: 8 (13 April 1996).

*Scolopax minor* (American Woodcock)

Two records: 7 March 1981 (1) and 11 November 1987 (1).

*Phalaropus tricolor* (Wilson's Phalarope)

Records include 25-27 August 1977 (1), 10-20 August 1978 (1), 23-25 May 1979 (1), 3 June 1979 (1), 23-29 July 1979 (1), 25 August 1985 (1), and 18 July 1986 (1). Most records list one or two birds, but three were seen on 22 August 1989.

*Phalaropus lobatus* (Red-necked Phalarope)

Records include 24 May-3 June 1979 (1), 18 May 1980 (1), 25 May 1986 (1), 26-28 May 1988 (1), and 16-28 May 1991 (1). Peak count: 18 (5 September 1979; Kain, 1987).

*Phalaropus fulicarius* (Red Phalarope)

One record: 23 November - 28 December 1984 (1) (Kain, 1987).

*Larus atricilla* (Laughing Gull)

Records include 11 April 1982 (5), 2 November 1986 (1), and 28 August 1992 (1). Peak count: 5 (11 April 1982).

*Larus philadelphia* (Bonaparte's Gull)

Records include 5 April 1980 (1), 16 May 1983 (1), 26 March 1983 (2), 29 December 1987 (6), 7 February 1989 (5), and 8 November 1991 (8). Peak count: 39 (21 March 1982).

*Larus delawarensis* (Ring-billed Gull)

Records include 15 January 1988 (210), 8 October 1988

(2), 13 October 1990 (1), 28 January 1996 (30), and 20 February 2001 (1). Peak count: 450 (8 March 1980).

*Larus argentatus* (Herring Gull)

Records include 28 February 1980 (1), 18 March 1987 (3), 15 January 1988 (2), 3 October 1989 (1), 31 January 1991 (1), and 16 December 1992 (2). Peak count: 10 (20 April 1992).

*Larus fuscus* (Lesser Black-backed Gull)

An adult observed on 4 April 1984 represents the only record for this species for the Mountain and Valley region of Virginia (Kain, 1987).

*Sterna caspia* (Caspian Tern)

Records include 4 September 1981 (1), 4 April 1992 (1), and 15 September 1992 (1). Peak count: 4 (22 April 1988).

*Sterna hirundo* (Common Tern)

Records include 11 November 1979 (1), 28 July 1980 (1), 9 September 1988 (1), and 4 September 1981 (2).

*Sterna fosteri* (Forster's Tern)

Three records: 5 October 1983 (6), 24 May 1985 (1), and 31 July 1985 (1).

*Chlidonias niger* (Black Tern)

Records include 28 July 1980 (3), 7 September 1981 (2), 2 September 1983 (1), 12 August 1986 (1), 16 August 1987 (1), 12 August 1988 (1), 9 September 1988 (4), 25 July 1985 (1), and 31 August 1987 (1).

\* *Columba livia* (Rock Pigeon)

Common permanent resident; introduced species. Peak count: 20 (1 January 1983).

\* *Zenaida macroura* (Mourning Dove)

Common permanent resident. Peak count: 23 (1 January 1988).

*Coccyzus erythrophthalmus* (Black-billed Cuckoo)

One record: 28 September 1991 (1).

\* *Coccyzus americanus* (Yellow-billed Cuckoo)

Records include 24 May 1986 (1), 26 October 1989 (1), 30 April 1991 (1), and 6 August 1992 (1).

*Tyto alba* (Barn Owl)

Two records: 18 July 1982 (2) and 21 July 1983 (3).

+ *Megascops asio* (Eastern Screech-Owl)

Common permanent resident.

+ *Bubo virginianus* (Great Horned Owl)  
Uncommon permanent resident.

*Chordeiles minor* (Common Nighthawk)  
Records include 11 October 1982 (2), 3 May 1983 (4),  
17 October 1988 (1), and 21 May 1993 (1).

*Caprimulgus vociferus* (Whip-poor-will)  
The one record is of one individual heard calling on 31  
March 1982.

*Chaetura pelagica* (Chimney Swift)  
Records include 12 April 1980 (1), 17 April 1987 (15),  
16 April 1983 (38), and 14 April 1991 (3). Peak count:  
300 (26 September 1995).

+ *Archilochus colubris* (Ruby-throated Hummingbird)  
Records include 26 April 1984 (1), 30 April 1985 (1),  
25 April 1987 (1), and 26 July 1992 (1).

\* *Ceryle alcyon* (Belted Kingfisher)  
Common permanent resident.

+ *Melanerpes carolinus* (Red-bellied Woodpecker)  
Common permanent resident.

*Sphyrapicus varius* (Yellow-bellied Sapsucker)  
No summer records. Records include 28 February 1981  
(1), 9 January 1985 (1), and 16 December 2000 (1).

\* *Picoides pubescens* (Downy Woodpecker)  
Common permanent resident. 5 June 1983 (1 adult on  
nest).

*Picoides villosus* (Hairy Woodpecker)  
Records include 14 November 1982 (1), 8 January 1988  
(1), and 16 December 2000 (3).

\* *Colaptes auratus* (Northern Flicker)  
Common permanent resident.

+ *Dryocopus pileatus* (Pileated Woodpecker)  
Common permanent resident.

\* *Contopus virens* (Eastern Wood-Pewee)  
Common summer resident. Records include 7 May  
1983 (2) and 29 May 2000 (1).

\* *Empidonax virens* (Acadian Flycatcher)  
Common summer resident. Records include 2 May  
1983 (1), 30 May 1983 (1), and 22 May 1987 (2).

\* *Empidonax traillii* (Willow Flycatcher)  
Records include 30 May 1981 (1), 23 May 1982 (2), 15

May 1989 (1), 18 June 1991 (1), and 19 April 1992 (2).

*Empidonax minimus* (Least Flycatcher)  
Two records: 18 September 1983 (1) and 6 June 1989  
(1).

\* *Sayornis phoebe* (Eastern Phoebe)  
Records include 6 March 1983 (1), 14 January 1984  
(1), 3 April 1994 (1), 6 October 1995 (1), and 2  
December 1999 (1).

\* *Myiarchus crinitus* (Great Crested Flycatcher)  
Common summer resident. Records include 1 May  
1983 (1), 25 April 1992 (1), and 7 August 1992 (1).

*Tyrannus verticalis* (Western Kingbird)  
One record: 6 October 1985 (1).

\* *Tyrannus tyrannus* (Eastern Kingbird)  
Summer resident. Records include 26 April 1984 (2)  
and 1 May 1987 (1). Peak count: 17 (8 September  
1971; Kinzie, 1985).

*Tyrannus forficatus* (Scissor-tailed Flycatcher)  
One record: 27 September 1987 (1).

\* *Lanius ludovicianus* (Loggerhead Shrike)  
Records include 12 February 1984 (1), 1 January 1986  
(1), 5 July 1987 (2 adult, 1 immature), 29 August 1988  
(1), 12 September 1989 (2), 9 November 1990 (1), and  
15-20 March 1992 (1). There are no records of this  
declining, state threatened species since 1992.

*Vireo griseus* (White-eyed Vireo)  
Records include 28 April 1984 (1), 26 October 1986  
(1), 28 April 1991 (2), 18 April 1992 (1), and 16 April  
1994 (1).

*Vireo flavifrons* (Yellow-throated Vireo)  
Records include 31 May 1983 (1) and 28 October 1989  
(1).

*Vireo solitarius* (Blue-headed Vireo)  
Records include 22 October 1982 (1) and 6 April 1991  
(1).

*Vireo gilvus* (Warbling Vireo)  
Records include 19 May 1985 (1) and 6 April 1991 (2).

*Vireo philadelphicus* (Philadelphia Vireo)  
Three records: 29 September 1984 (1), 20 October 1987  
(1), and 22 September 1990 (1).



*\*Vireo olivaceus* (Red-eyed Vireo)

Common summer resident. Records include 5 April 1982 (1), 28 April 1984 (1), and 21 August 1989 (1).

*\*Cyanocitta cristata* (Blue Jay)

Common permanent resident.

*\*Corvus brachyrhynchos* (American Crow)

Common permanent resident.

*Corvus corax* (Common Raven)

Uncommon permanent resident. Peak count: 6 (10 October 1982; Kinzie, 1985).

+ *Progne subis* (Purple Martin)

Records include 7 April 1982 (8), 23 March 1991 (3), and 20 March 1992 (2). Peak count: 15 (21 March 1992).

*\*Tachycineta bicolor* (Tree Swallow)

Records include 22 June 1983 (5 eggs in bluebird box), 20 October 1983 (4), 20 March 1992 (1), and 11 April 1996 (1). Peak count: 68 (4 October 1987).

*\*Stelgidopteryx serripennis* (Northern Rough-winged Swallow)

Records include 4 April 1980 (1), 28 March 1981 (3), 25 March 1987 (1), 23 March 1991 (4), and 4 November 1995 (1). Peak count: 8 (7 April 1990).

*Riparia riparia* (Bank Swallow)

Records include 20 April 1982 (1), 23 April 1984 (1), 21 April 1987 (6), 19 April 1992 (4), and 5 May 1992 (5).

*Petrochelidon pyrrhonta* (Cliff Swallow)

Records include 3 May 1984 (1), 26 September 1989 (10), 19 April 1991 (5), and 5 October 1995 (1). Peak count: 50 (24 May 1985; Kinzie, 1985).

*\*Hirundo rustica* (Barn Swallow)

Common summer resident. Records include 2 April 1980 (1), 25 March 1987 (2), 20 March 1992 (3), and 5 October 1995 (1). Peak count: 12 (12 April 1980).

*\*Poecile carolinensis* (Carolina Chickadee)

Common permanent resident.

*Poecile atricapillus* (Black-capped Chickadee)

The few records include 10 November 1983 (1) and 15 November 1990 (1).

*\*Baeolophus bicolor* (Tufted Titmouse)

Common permanent resident.

*Sitta canadensis* (Red-breasted Nuthatch)

One record: 14 December 2000 (1).

+ *Sitta carolinensis* (White-breasted Nuthatch)

Common permanent resident.

*Certhia americana* (Brown Creeper)

Winter resident. Records include 21 November 1982 (1), 3 April 1983 (1) and 17 February 1996 (1). Peak count: 2 (3 February 1983).

*\*Thryothorus ludovicianus* (Carolina Wren)

Common permanent resident.

*\*Troglodytes aedon* (House Wren)

Records include 13 October 1981 (1), 20 April 1982 (1), 22 April 1989 (1), and 26 April 1993 (1).

*Troglodytes troglodytes* (Winter Wren)

Winter resident. Records include 20 December 1981 (1), 18 February 1984 (2), 27 October 1992 (1), and 29 November 1993 (3).

*Cistothorus palustris* (Marsh Wren)

Records include 7 May 1987 (1), 29 September 1992 (1), and 24 October 1993 (1).

*Regulus satrapa* (Golden-crowned Kinglet)

Winter resident. Records include 1 January 1983 (1), 4 November 1995 (4), and 21 February 1999 (1).

*Regulus calendula* (Ruby-crowned Kinglet)

Records include 4 April 1982 (2), 16 October 1983 (1), 1 January 1985 (3), and 2 December 1999 (5).

*\*Polioptila caerulea* (Blue-gray Gnatcatcher)

Common summer resident. Records include 13 April 1984 (1), 30 March 1991 (1), 13 October 1992 (1), and 8 April 1995 (1).

*\*Sialia sialis* (Eastern Bluebird)

Common permanent resident.

*Catharus fuscescens* (Veery)

Two records: 25 May 1987 (1) and 5 May 1992 (1).

*Catharus minimus* (Gray-cheeked Thrush)

One record: 29 September 1990 (1).

*Catharus ustulatus* (Swainson's Thrush)

Uncommon migrant. Records include 29 April 1983 (1), 20 May 1987 (1), 29 September 1990 (1), and 30 September 1991 (1).

*Catharus guttatus* (Hermit Thrush)

Common winter resident and migrant. Records include 3 April 1983 (2), 13 April 1985 (1), 7 April 1991 (1), and 11 April 1992 (1).

\* *Hylocichla mustelina* (Wood Thrush)

Common summer resident. Records include 29 April 1983 (1), 26 April 1984 (2), and 2 August 1993 (1).

\* *Turdus migratorius* (American Robin)

Common permanent resident. Records include 5 April 1985 (1) and 2 December 1999 (1).

+ *Dumetella carolinensis* (Gray Catbird)

Probable summer resident. Records include 27 April 1982 (1) and 25 April 1992 (1). No winter records.

\* *Mimus polyglottos* (Northern Mockingbird)

Common permanent resident.

\* *Toxostoma rufum* (Brown Thrasher)

Records include 14 April 1984 (2), 7 March 1987 (1), and 10 August 1992 (2).

\* *Sturnus vulgaris* (European Starling)

Common permanent resident; introduced species. Peak count: 15 (1 January 1988).

*Anthus rubescens* (American Pipit)

Records include 1 January 1982 (1), 30 October 1983 (7), 28 October 1989 (6), 4 April 1993 (1), 1 December 1993 (3), and 5 November 1995 (2). Peak count: 10 (2 October 1993).

\* *Bombycilla cedrorum* (Cedar Waxwing)

Common permanent resident. Peak count: 5 (20 August 1990).

*Vermivora pinus* (Blue-winged Warbler)

Records include 25 August 1990 (1), 29 April 1991 (1), and 27 July 1991 (1).

*Vermivora peregrina* (Tennessee Warbler)

Records include 2 October 1983 (1), 4 May 1984 (1), 9 October 1989 (1), and 14 September 1990 (1). Peak count: 5 (16 September 1981).

*Vermivora celata* (Orange-crowned Warbler)

Records include 28 October 1984 (1), 12 October 1987 (1), and 14 September 1990 (1). No spring records.

*Vermivora ruficapilla* (Nashville Warbler)

Records include 20 September 1981 (1), 11 September 1983 (1), 14 September 1990 (1), 6 October 1993 (1),

and 8 November 1983 (1). Peak count: 2 (20 September 1981).

*Parula americana* (Northern Parula)

Records include 20 September 1981 (1), 13 April 1985 (1), and 26 April 1993 (1).

\* *Dendroica petechia* (Yellow Warbler)

Common summer resident. Records include 29 April 1983 (3), 8 August 1992 (4), and 26 April 1993 (1).

*Dendroica pensylvanica* (Chestnut-sided Warbler)

Records include 7 May 1984 (1), 3 May 1983 (1), 30 April 1991 (1), and 18 May 1992 (2). No summer records.

*Dendroica magnolia* (Magnolia Warbler)

Records include 11 October 1981 (1), 15 September 1983 (1), 18 May 1992 (1), and 16 September 1995 (2).

*Dendroica tigrina* (Cape May Warbler)

Records include 20 September 1990 (4), 8 August 1991 (1), 3 May 1992 (1), and 16 September 1995 (1).

*Dendroica caerulescens* (Black-throated Blue Warbler)

Records include 9 May 1984 (1), 29 April 1991 (1), 4 May 1992 (1), and 30 April 1993 (1). No summer records.

*Dendroica coronata* (Yellow-rumped Warbler)

Common winter resident. Records include 5 January 1982 (1) and 12 December 2000 (13).

*Dendroica virens* (Black-throated Green Warbler)

Records include 15 September 1983 (1) and 10 April 1992 (1).

*Dendroica fusca* (Blackburnian Warbler)

Records include 7 May 1984 (1) and 14 September 1990 (1).

*Dendroica dominica* (Yellow-throated Warbler)

Records include 26 May 1984 (1), 23 April 1987 (2), 7 May 1991 (1), and 11 April 1992 (1).

\* *Dendroica pinus* (Pine Warbler)

Two records: 12 October 1987 (1) and 29 July 1988 (2). A pair observed on the latter date indicates possible breeding activity.

+ *Dendroica discolor* (Prairie Warbler)

The few records include 29 September 1984 (1), 23 April 1989 (2), and 17 April 1991 (1).

*Dendroica palmarum* (Palm Warbler)

Records include 22 September 1983 (1), 24 November 1991 (2), and 19 April 1992 (2). Peak count: 35 (2 October 1993; Kinzie, 1985).

*Dendroica castanea* (Bay-breasted Warbler)

Two records: 22 September 1990 (1) and 17 September 1988 (1).

*Dendroica striata* (Blackpoll Warbler)

Records include 17 May 1981 (1), 15 October 1990 (1), and 18 May 1992 (2).

*Dendroica cerulea* (Cerulean Warbler)

Records include 18 May 1982 (1), 11 May 1982 (1), and 15 May 1989 (1).

\* *Mniotilta varia* (Black-and-white Warbler)

Uncommon summer resident. Records include 11 October 1981 (1), 13 April 1982 (1), 9 April 1991 (2), and 24 June 1994 (1).

\* *Setophaga ruticilla* (American Redstart)

Common summer resident. Records include 20 September 1981 (1), 25 April 1987 (1), 29 July 1988 (1), and 20 April 1991 (1).

\* *Protonotaria citrea* (Prothonotary Warbler)

Uncommon summer resident. Records include 2 May 1982 (2), 4 May 1984 (1), 7 May 1984 (1 adult on nest), 18 April 1993 (1), and 14 May 1994 (2).

\* *Helmitheros vermivorus* (Worm-eating Warbler)

Common summer resident. Records include 3 April 1983 (1), 16 August 1983 (1), and 12 May 1990 (1).

\* *Seiurus aurocapilla* (Ovenbird)

Common summer resident. Records include 29 April 1983 (1) and 30 September 1983 (1).

*Seiurus noveboracensis* (Northern Waterthrush)

Records include 8 May 1988 (1), 30 April 1991 (2), 20 April 1992 (1), and 5 May 1992 (1). Peak count: 2 (11 May 1980).

\* *Seiurus motacilla* (Louisiana Waterthrush)

Records include 8 April 1984 (2) and 20 April 1992 (1).

*Oporornis formosus* (Kentucky Warbler)

Records include 30 April 1983 (1) and 3 May 1992 (1)

*Oporornis philadelphia* (Mourning Warbler)

Two records: 29 May 1984 (1) and 21 May 1987 (1).

\* *Geothlypis trichas* (Common Yellowthroat)

Uncommon summer resident. Records include 20 September 1981 (1), 19 May 1983 (1), 15 April 1983 (1), 29 July 1988 (1), and 6 October 1993 (1).

*Wilsonia citrina* (Hooded Warbler)

One record: 29 April 1991 (1).

*Wilsonia pusilla* (Wilson's Warbler)

Records include 20 September 1981 (1), 23 May 1982 (1), 23 September 1987 (1), and 20 September 1991 (1). Peak count: 3 (11 September 1983; Kinzie, 1985).

*Wilsonia canadensis* (Canada Warbler)

Records include 11 May 1981 (1), 15 September 1983 (1), 20 May 1987 (1), and 16 May 1992 (1). Peak count: 2 (16 May 1992).

\* *Icteria virens* (Yellow-breasted Chat)

Uncommon summer resident. Records include 15 May 1982 (3), 2 May 1984 (1), and 30 April 1990 (1). Peak count: 3 (15 May 1982).

\* *Piranga olivacea* (Scarlet Tanager)

Common summer resident. Records include 2 May 1983 (1) and 29 July 1988 (1).

\* *Pipilo erythrophthalmus* (Eastern Towhee)

Common summer resident, uncommon winter resident. Records include 1 January 1983 (1) and 29 August 1995 (1).

\* *Spizella passerina* (Chipping Sparrow)

Common summer resident. Records include 29 March 1981 (6), 29 July 1988 (2), and 15 August 1996 (1).

\* *Spizella pusilla* (Field Sparrow)

Common permanent resident.

*Pooecetes gramineus* (Vesper Sparrow)

Records include 13 April 1982 (2), 21 April 1987 (1), 30 March 1991 (1), 15 September 1993 (1), and 15 October 1994 (1).

*Chondestes grammacus* (Lark Sparrow)

Records include 13 April 1982 (2), 8 and 20 August 1991 (2).

*Passerculus sandwichensis* (Savannah Sparrow)

Records include 21 March 1981 (3), 3 April 1989 (3), 24 April 1993 (2), and 17 September 1993 (3).

*Ammodramus savannarum* (Grasshopper Sparrow)

Records include 10 October 1987 (1) and 25 April 1992 (2).

*Ammodramus henslowii* (Henslow's Sparrow)

Two records: 30 May 1991 (1) and 15 May 1991 (1). No recent STP records of this state threatened bird.

*Ammodramus leconteii* (Le Conte's Sparrow)

One record: 4 September 1990 (1).

*Passerella iliaca* (Fox Sparrow)

Uncommon winter resident. Records include 14 November 1982 (1), 12 March 1983 (2), 2 April 1994 (1), and 21 October 1995 (1).

\* *Melospiza melodia* (Song Sparrow)

Common permanent resident.

*Melospiza lincolni* (Lincoln's Sparrow)

Records include 27 September 1984 (1), 12 October 1987 (1), and 16 October 1994 (1). Peak count: 4 (11 October 1981).

*Melospiza georgiana* (Swamp Sparrow)

Records include 11 October 1981 (1), 8 April 1984 (1), 5 May 1992 (1), and 11 April 1993 (1).

*Zonotrichia albicollis* (White-throated Sparrow)

Common winter resident. Records include 27 September 1984 (1) and 27 November 1999 (3). Peak count: 15 (11 October 1981).

*Zonotrichia leucophrys* (White-crowned Sparrow)

Uncommon winter resident. Records include 11 and 13 October 1981 (2). Peak count: 20 (1 January 1991).

*Junco hyemalis* (Dark-eyed Junco)

Common winter resident. Records include 2 February 1984 (1) and 5 December 1990 (3). Peak count: 17 (5 March 1997).

\* *Cardinalis cardinalis* (Northern Cardinal)

Common permanent resident.

*Peucaea ludoviciana* (Rose-breasted Grosbeak)

Records include 20 September 1981 (1), 3 May 1982 (2), and 6 October 1993 (1). Peak count: 10 (2 May 1983).

\* *Passerina caerulea* (Blue Grosbeak)

Uncommon summer resident. Records include 2 May 1982 (1), 20 May 1987 (2), 3 May 1983 (3), and 26 September 1995 (1).

\* *Passerina cyanea* (Indigo Bunting)

Common summer resident. Records include 26 April 1992 (5) and 1 May 1993 (1). Peak count: 24 (11 May 1980).

*Dolichonyx oryzivorus* (Bobolink)

Records include 10 October 1982 (1), 17 September 1983 (1), 20 August 1991 (1), and 12 May 1995 (1). Peak count: 3 (17 September 1993).

\* *Agelaius phoeniceus* (Red-winged Blackbird)

Common summer resident. Records include 9 October 1981 (21) and 15 November 1995 (5).

*Sturnella magna* (Eastern Meadowlark)

Permanent resident. Records include 3 January 1987 (8) and 17 September 1983 (1). Peak count: 14 (14 January 1984).

*Xanthocephalus xanthocephalus* (Yellow-headed Blackbird)

One record: 2-4 September 1978 (1).

*Euphagus carolinus* (Rusty Blackbird)

Records include 3 April 1983 (3), 11 November 1987 (4), 15 April 1991 (1), and 26 November 1993 (1). Peak count: 50 (26 October 1982).

\* *Quiscalus quiscula* (Common Grackle)

Common summer resident. Records include 9 December 1996 (1) and 23 May 1999 (1). Peak count: 50 (24 February 1983).

\* *Molothrus ater* (Brown-headed Cowbird)

Common summer resident. Records include 20 March 1981 (1), 30 March 1989 (2), and 16 April 1990 (1).

*Icterus spurius* (Orchard Oriole)

One record: 28 April 1982 (1).

\* *Icterus galbula* (Baltimore Oriole)

Uncommon summer resident. Records include 4 May 1982 (1), 4 May 1982 (1), and 29 July 1988 (1).

*Carpodacus purpureus* (Purple Finch)

Records include 20 October 1981 (1), 30 April 1983 (1), 23 November 1989 (1), and 16 December 1990 (1). Peak count: 2 (17 April 1988).

\* *Carpodacus mexicanus* (House Finch)

Permanent resident; introduced species. Peak count: 65 (16 December 2000).

*Carduelis pinus* (Pine Siskin)  
One record: 26 April 1986 (1).

\* *Carduelis tristis* (American Goldfinch)  
Common permanent resident.

*Coccothraustes vespertinus* (Evening Grosbeak)  
One record: 13 November 1983 (8).

\* *Passer domesticus* (House Sparrow)  
Common permanent resident; introduced species.

### Exotic Species

*Anser cygnoides* (Chinese Goose)  
One record: 21 March 1993 (2).

*Aix galericulata* (Mandarin Duck)  
One record: 14 September 1997 (1).

*Tadorna ferruginea* (Ruddy Shelduck)  
One record: 3 April 1988 (1).

*Cairina moschata* (Muscovy)  
Permanent resident; introduced species.  
Records include 28-29 August 1992 (1).

*Aratinga finschi* (Crimson-fronted Parakeet)  
One record: 4-5 July 1991 (1).

*Streptopelia risoria* (Ringed Turtle-Dove)  
Two records: 19 July 1985 (2) and 22 May 1991 (1).

*Nandayus nenday* (Black-hooded Parakeet)  
One record: 22 July 1989 (2).

### DISCUSSION

For almost thirty years, local birdwatchers have made astute observations of 242 species of transient and resident birds at STP. Observers have concentrated their searches for migrant waders at STP and as a result have recorded 32 species of shorebirds visiting the site, with the Killdeer (*Charadrius vociferus*) being the only documented breeding species. The rich diversity of shorebirds that visit this inland site varies according to water levels of the impoundments, time of day, and time of year. Major weather patterns, such as the remnants of tropical storms, play an important role in the number and variety of birds that stop here. Although usually not extremely destructive locally, the tropical depressions that pass through the area often create significant fluctuations in water levels within the

Table 1. Summary of shorebirds observed at Roanoke Regional Airport (RA) and Roanoke Sewage Treatment Plant (STP) on 18 August 1985.

	RA	STP
Black-bellied Plover ( <i>Pluvialis squatarola</i> )	101	3
American Golden Plover ( <i>Pluvialis dominica</i> )	1	-
Semipalmated Plover ( <i>Charadrius semipalmatus</i> )	2	1
Killdeer ( <i>Charadrius vociferus</i> )	8	7
Greater Yellowlegs ( <i>Tringa melanoleuca</i> )	2	1
Lesser Yellowlegs ( <i>Tringa flavipes</i> )	20	5
Solitary Sandpiper ( <i>Tringa solitaria</i> )	-	3
Willet ( <i>Catoptrophorus semipalmatus</i> )	1	-
Upland Sandpiper ( <i>Bartramia longicauda</i> )	4	-
Hudsonian Godwit ( <i>Limosa haemastica</i> )	8	-
Ruddy Turnstone ( <i>Arenaria interpres</i> )	13	-
Red Knot ( <i>Calidris canutus</i> )	2	-
Sanderling ( <i>Calidris alba</i> )	7	2
Semipalmated Sandpiper ( <i>Calidris pusilla</i> )	20	3
Least Sandpiper ( <i>Calidris minutilla</i> )	2	5
Pectoral Sandpiper ( <i>Calidris melanotos</i> )	30	11
Stilt Sandpiper ( <i>Calidris himantopus</i> )	1	-
Buff-breasted Sandpiper ( <i>Tryngites subruficollis</i> )	3	1
Short-billed Dowitcher ( <i>Limnodromus griseus</i> )	53	3
Total species	18	12
Total shorebirds	278	45

sludge lagoons and basins which the birds tend to use. Typical of sludge farms nationwide, these open-air lagoons produce millions of insects and provide a relatively safe haven for many of these birds that have been forced down to weather the storms, or as a stopover on their seasonal migrations. On 18 August 1985, Hurricane Danny passed over Roanoke leaving a wake of shorebirds that has never been equaled. The bulk of the shorebird fallout, which included eighteen species, was found at the Roanoke Regional Airport, specifically the General Aviation Field, but a number of shorebird species was also located at STP (Table 1). Most notable at STP from that event were Black-bellied Plover (*Pluvialis squatarola*), and Buff-breasted Sandpiper (*Tryngites subruficollis*) (Donahue, pers. obs.). With continued interest in bird watching, future observations at STP will likely confirm suspected breeding species and also add to the existing list of bird species.

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#### LITERATURE CITED

- American Ornithologists' Union. 2003. Forty-fourth supplement to the American Ornithologists' Union Check-list of North American Birds. *Auk* 120: 923-932.
- Ashkenazi, S. 2001. Long-term trends in the breeding populations of waterbirds (1951-1985) at a sewage treatment plant. *Ostrich* 72: 10-19.
- DeCecco, J. A., & R. J. Cooper. 1996. Shorebird migration at a Mississippi River wastewater treatment plant. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 50: 221-227.
- Fuller, R. J., & D. E. Glue. 1980. Sewage works as bird habitats in Britain. *Biological Conservation* 17: 165-181.
- Kain, T. (ed). 1987. Virginia's Birdlife: An Annotated Checklist. 2nd Edition. Virginia Avifauna Number 3. Virginia Society of Ornithology. 127 pp.
- Keller, C. E. 1972. Shorebird migration at the Indianapolis Sewage Disposal Plant. *Indiana Audubon Quarterly* 50: 124-135.
- Kinzie, B. L. 1985. Birds of the Roanoke Valley: An Annotated Checklist. Privately Printed. 76 pp.
- Middleton, N. C. 1982. Fame comes to Roanoke's "STP" as stopover for transients. *The Raven* 53: 43-47.
- Peterson, R. T. 1980. A Field Guide to the Birds of Eastern and Central North America. Houghton Mifflin Company, Boston, MA. 384 pp.
- Reid, F. A., W. D. Rundle, M. W. Sayre, & P. R. Covington. 1983. Shorebird migration chronology at two Mississippi River Valley wetlands of Missouri. *Biological Conservation* 47: 103-115.
- Robbins, C. R., B. Bruun, & R. S. Zim. 1966. A Guide to Field Identification, Birds of North America. Golden Press, New York, NY. 340 pp.

## Status of the Smooth Greensnake (*Opheodrys vernalis*) in North Carolina and Virginia

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### ABSTRACT

*Opheodrys vernalis* occurs in high elevation open habitats in the southern Appalachians in West Virginia, Virginia, and formerly in North Carolina. I review the available literature, museum, and personal observation records of this colubrid snake in the southeastern portion of its wide and fragmented range in North America. Extant populations occur in portions of the Blue Ridge Mountains along the Blue Ridge Parkway and Skyline Drive in Shenandoah National Park in Virginia. Populations also exist atop high elevation ridges in the Ridge and Valley Physiographic Province in the George Washington and Jefferson National Forests and other locations. A recently discovered specimen in Floyd County, Virginia, suggests that populations remain extant south of the James River in the Blue Ridge Mountains. Three locations are verified for Bland and Giles counties south of the New River. All other known populations occur north of the New River. A population at Mountain Lake Biological Station, Giles County, has apparently become extirpated. An extant specimen from the mountains of North Carolina collected in 1871, observations by W.H. Weller in 1928-1930, and observations by R.L. Hoffman in 1952 represent the only known records of *O. vernalis* in North Carolina. This snake is apparently extinct in that state. *Opheodrys vernalis* populations may be declining due to lack of maintenance of high elevation grasslands and balds by natural or prescribed fire. Conservation of this species in the southern Appalachians requires management of all known locations through use of prescribed fire and maintenance of open grassy areas.

**Key words:** Blue Ridge Parkway, conservation, management, Mountain Lake Biological Station, National Forest, North Carolina, *Opheodrys vernalis*, Shenandoah National Park, Virginia.

### INTRODUCTION

The Smooth Greensnake (*Opheodrys vernalis*) occurs throughout an extensive, albeit patchy, range across the northern half of the United States and into southern Canada (Conant & Collins, 1998). Its distribution extends from Nova Scotia south through the Virginia mountains and west to Manitoba and Utah, then south through the Rocky Mountains to northern Mexico (Walley, 2003). Most of the western and southwestern areas occupied by this snake are disjunct and isolated (e.g., the Midwest, southeastern Texas, New Mexico, and Chihuahua, Mexico). A Pleistocene fossil was recovered in northern Florida (Meylan, 1982); no records occur in the hiatus between this location and the southern Appalachians. The fragmentary distribution of this species, especially westward and southward, implies a withdrawal to the

north during a more austral occurrence, presumably post-Pleistocene.

Expansion and contraction of ranges are a normal part of a species' evolutionary history and are presumably characteristic for most, if not all, organisms in eastern North America. Range contractions of the Timber Rattlesnake (*Crotalus horridus*) and the Eastern Diamond-backed Rattlesnake (*Crotalus adamanteus*) result from impacts of modern human activities on the landscape and on the snakes themselves (Brown, 1993; Martin & Means, 1999-2000; Timmerman & Martin, 2003). Changes in the distribution pattern of *Opheodrys vernalis* in the southern Appalachian Mountains provide another example of range contraction mediated to some extent by human activities.

The known distribution of *O. vernalis* in Virginia can be visualized from its treatment in Mitchell (1994) and Mitchell & Reay (1999). All of the available

capture and observation records are for the northern Blue Ridge Mountains, except for one (see below for discussion), and the Ridge and Valley Physiographic Province north of Bland County. All known localities in this portion of its range are above 1100 ft (340 m) elevation (Hoffman, 1986). Smooth Greensnakes occur throughout most of the highlands of West Virginia, including four counties bordering Virginia: Greenbrier, Pocahontas, Pendleton, and Hardy (Greene & Pauley, 1987). This is an example of a boreal species distribution pattern. My review of the putative contraction of this species' range in the southern Appalachians is based on observations provided by Richard L. Hoffman (pers. comm.), the Natural Heritage Division of the Virginia Department of Conservation and Recreation, museum records, personal observations of this snake, and my interest in its conservation status in this region. I provide a narrative review of the localities from historical collections and observation dates, and add recommendations for conservation and management of this colubrid snake.

#### *OPHEODRYS VERNALIS* IN VIRGINIA

Probably the first Virginia specimen of *O. vernalis* to be secured was taken at Mountain Lake, Giles County, by Paul R. Burch; the exact date is unknown but likely to have been after 1936 (Hoffman & Mitchell, 1994). Uhler et al. (1938) reported that five *O. vernalis* were collected by the Civilian Conservation Corps (CCC) in the George Washington National Forest between September 1936 and May 1937. The U.S. Biological Survey vertebrate collection that contained some of the CCC specimens was formerly housed at the Patuxent Wildlife Research Center, Maryland; it was transferred to the Smithsonian Institution in the 1990s. Unfortunately, none of the *O. vernalis* specimens from the CCC days remain extant. Only two of these records have locality information: North River Gap and Ramsey's Draft, both in Augusta County (based on species cards at Patuxent Wildlife Research Center, Laurel, Maryland; now in the Smithsonian Institution; examined by JCM in 1984). Dunn (1936) did not include this species in his unpublished mimeographed checklist of amphibians and reptiles of Virginia, nor did Wright & Wright (1952) in their checklist of snakes of the United States and Canada.

A specimen in the Smithsonian Institution (USNM 10800) labeled as *Cyclophis* (= *Opheodrys*) *vernalis* was collected on 21 May 1878 at Chula, Amelia County, Virginia. It was cited as a valid Virginia locality by Yarrow (1882), Cope (1900), Dunn (1918), and Linzey

& Clifford (1981). The specimen cannot be found in the USNM collection (K. Tighe, pers. comm., 10 January 2007) and is presumed erroneous due to its collection locality being far outside the known range of this species (Mitchell, 1994).

During the 1940s, Richard L. Hoffman encountered *O. vernalis* several times a year up to 1950 around Clifton Forge, Alleghany County (Hoffman, 1945, 1986). That only three found their way into scientific collections (USNM 127598-99, 133049) simply reflected his reluctance to kill and preserve vertebrates (R. L. Hoffman, Virginia Museum of Natural History, pers. comm.). Hoffman (1986) noted that the Rough Greensnake (*O. aestivus*) and *O. vernalis* occurred sympatrically around Clifton Forge in the 1940s. Hoffman (pers. comm.) found one on Co. Rt. 758 in the summer of 1962 at the Roanoke-Montgomery county line 16 km southwest of Catawba. No other *O. vernalis* were seen by Hoffman in the area for another 13 years, when in 1975 he found a gravid female on Jack Mountain southeast of Monterey in Highland County (R. L. Hoffman, pers. comm.). The individual was photographed and released and the resultant Kodachrome slide deposited in the Virginia Herpetological Society photographic collection. Since 1962, R. L. Hoffman (pers. comm.) has driven conservatively a half-million miles on western Virginia roads and expended thousands of field hours without seeing another Smooth Greensnake, alive or as a road-kill.

In 1951, Walter Newman and R. L. Hoffman found a road-killed *O. vernalis* on Va. Rt. 311 west of Newcastle, Craig County (USNM 144115). Linzey (1959) found *O. vernalis* on the Blue Ridge Parkway at Clarks Gap in Rockbridge County and near Iron Mine Hollow, on the Blue Ridge Parkway in Botetourt County, both in 1957 (apparently housed in his private collection). W. H. Martin (pers. comm.) observed a DOR specimen on 8 August 1969 at the south entrance of the Bluff Mountain tunnel on the Blue Ridge Parkway in Amherst County.

Douglas Robinson collected a male *O. vernalis* 52 m S of the north entrance of Shenandoah National Park on 27 June 1953 (American Museum of Natural History, AMNH 75820). Witt (1958, 1963) reported on Smooth Greensnakes that he and others collected from Buffalo Gap in Amherst County on 2 September 1956 (USNM 138740), Jarman Gap Shenandoah National Park (SNP) in Augusta County on 24 May 1951 (USNM 146633), and Page County near Big Meadows in SNP on 6 October 1960 (USNM 145929). Witt also collected a road kill on Skyline Drive in SNP opposite Tanner's Ridge Overlook on 16 July 1957 (USNM 139393). Another specimen collected on 12 April 1975



at Big Meadows (SNP) was in the former VPI&SU collection but is now in the AMNH (129608). Additional specimens from SNP include Carnegie Museum of Natural History (CMNH) 53580 at Milepost 69, and observations by W. H. Martin (pers. comm.) from Pinefield Gap on 13 May 1974, MP 95.7 on 18 September 1976, and Loft Mountain Picnic ground on 29 April 1975. W.H. Martin (pers. comm.) found eleven snakes at Big Meadows and other locations on Skyline Drive in the Central and Southern districts of Shenandoah National Park between 1967 and 1975.

Two other specimens in the Smithsonian Institution provide records for Catawba, Roanoke County (27 May 1962; USNM 149120), and on the Skyline Drive at South Bluff Mountain, Amherst County (8 August 1969; USNM 167179). S. Blair Hedges collected a specimen southeast of Healing Springs in Bath County on 25 September 1976 (USNM 219051). Mercedes Foster added another *O. vernalis* to the Smithsonian collection from the George Washington National Forest on Forest Service Road 85 near the Virginia-West Virginia state line in Rockingham County (21 July 1990, USNM 304289).

Gary W. Woodyard (formerly with the Virginia Department of Game and Inland Fisheries, in correspondence to F. J. Tobey on 14 November 1974) noted that he had observed several Smooth Greensnakes (as well as *O. aestivus*) at Buckhorn Draft in Gathright Wildlife Management Area, Bath County, in 1967; on Coles Mountain, also in Bath County, in 1974; around Pearisburg, Giles County, in the early 1960s; and in Bland County 3.6 km SW of the Giles County line near Walker's Creek in the 1960s. All of these locations were plotted on the *O. vernalis* map in Tobey (1985). Tobey also plotted a location 6.4 km N Bristol on Walker Mountain, Washington County, provided by an unknown source. This was apparently based on a putative specimen in the University of Tennessee, Knoxville, herpetological collection. However, I could not locate it when I searched the collection in 1976, nor did its curator know about such a specimen (A. C. Echternacht, pers. comm.).

John Pagels and the Virginia Commonwealth University Mammalogy class collected a specimen from Paddys Knob in Bath County on 4 September 1974 (North Carolina Museum of Natural Sciences NCSM 68688). A specimen collected by S. B. Hedges from Douthat State Park, Bath County, in 1979 was in the George Mason University Vertebrate Collection (GMU 84) but the collection is now in the Smithsonian Institution (uncatalogued). Twelve specimens were collected near the summit of Bald Knob on Warm Springs Mountain, Bath County, by J. C. Mitchell and

C. A. Pague on 23 August 1984 (USNM 516623-516634). Most of these specimens were neonates from a clutch of eggs found on that date. A specimen from Red Oak Knob near the West Virginia line in Highland County was collected by J. Pagels on 9 October 1987 (NCSM 68686). Richard L. Hoffman (pers. comm.) captured a gravid female near Monterey, Highland County, in 1975 and D. A. Young (1993) reported "several" on high elevation balds on Alleghany and Lantz mountains, Highland County, in June 1986. Three collections from Shenandoah Mountain in the George Washington National Forest by J. C. Mitchell, C. A. Pague and others on 2 June 1987 were on Bother Knob (USNM 516647-516648), Flagpole Knob (USNM 516635-516638), and Skidmore Ridge (USNM 516640-516646).

Nine *O. vernalis* were among the road-killed snakes examined by JCM on the Blue Ridge Parkway and Skyline Drive during 1979-1990, when 469 snakes were salvaged and preserved by National Park Service rangers and staff (the collection is housed in the Carnegie Museum of Natural History; CMFS 146601, 146066, 122773, 124875, 146102, 146109, 146088, 146091, 146118). The specimens represented the following counties: Augusta, Greene, Madison, and Rockingham. I found two *O. vernalis* during searches in Big Meadows, Shenandoah National Park, on 24 July 1990 and 26 June 1991. S. M. Roble and A. C. Chazal (Virginia Natural Heritage Program, pers. comm.) photographed an *O. vernalis* in Shenandoah National Park on 28 June 2005 on a forested trail leading to Rocky Mountain (38° 17.93' N, 78° 40.40' W, 851 m [2793 ft] ASL), Rockingham County, Virginia). This site is 32 km southwest of Big Meadows.

Most recently, specimens from Frederick County (University of Georgia Museum of Natural History, GMNH 49215) collected in 1996 and Shenandoah County, Virginia (GMNH 49214) collected in 2001, were reported by Akre (2003) and Akre & Robinson (2003). Roberts & Tickle (2004) captured and photographed one on Brushy Mountain, Bland County, in August 2004. First (2005) reported finding two *O. vernalis* in Floyd County in 2003 and 2004 along Goose Creek near Hemlock in the northern part of the county. These records validate the occurrence of this species in the southern Blue Ridge Mountains near Roanoke, based originally on a specimen collected in May 1962 in Roanoke County (USNM 149120).

The creation of the Virginia Herpetological Society in 1958 inaugurated a period of intensive field searching for locality records of all native species of amphibians and reptiles that resulted in the first comprehensive set of distribution maps for the state (Tobey, 1985). However, only 23 locality records of

Smooth Greensnakes were added after 1975 and all but the one in Floyd County (First, 2005) located north of the James River. These collective observations (Fig. 1) imply that viable populations exist in portions of the Blue Ridge Mountains and several locations in the Ridge and Valley Physiographic Province. *Opheodrys vernalis* occurs in unknown but apparently viable population sizes in the northern Blue Ridge, notably at Big Meadows in Shenandoah National Park (Witt, 1993; W. H. Martin, pers. comm.; JCM, pers. obs.).

Two areas south of that drainage that offer suitable habitat for Smooth Greensnakes in southwestern Virginia are Burkes Garden in Tazewell County (near the Bland County record) and Mt. Rogers in the Blue Ridge Mountains, Smyth and Grayson counties. In his extensive travels in these two regions, R. L. Hoffman (pers. comm.) is unaware of any reports of uniform-colored green snakes, nor are the ranger staffs of Grayson Highlands State Park and Mount Rogers National Recreation Area, Jefferson National Forest.

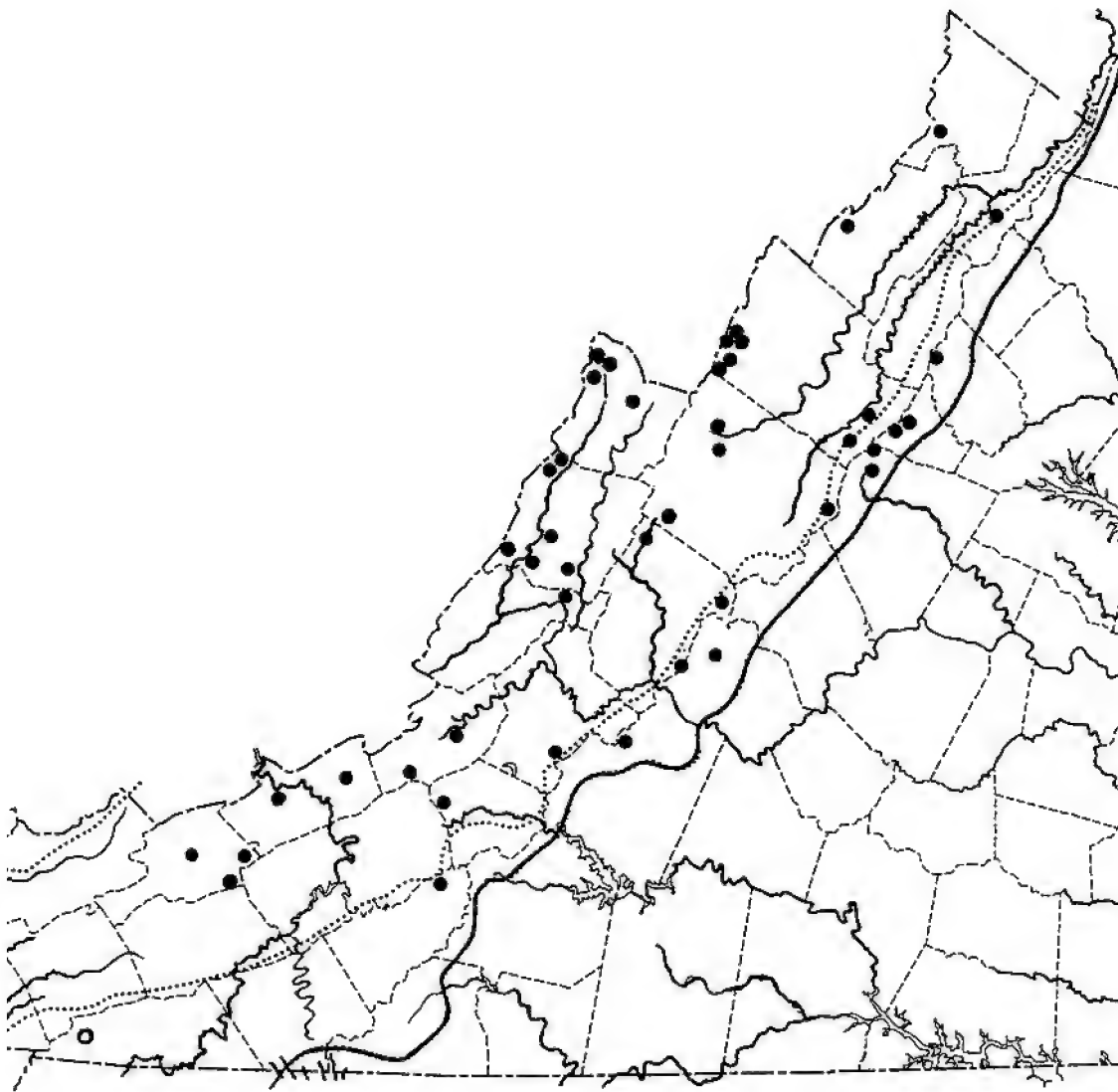


Fig. 1. Map of Virginia illustrating known locations for *Opheodrys vernalis*. The putative record for Washington County is indicated by an open circle. All other localities are shown as solid circles because they are within the known extant range of this species. The dark line to the east of the distribution pattern is the eastern margin of the Blue Ridge Physiographic Province.

*OPHEODRYS VERNALIS* IN NORTH CAROLINA

The tenuous evidence for the occurrence of *O. vernalis* in North Carolina is reviewed in Palmer & Braswell (1995) in their *O. aestivus* account under Remarks. The earliest (and still only) North Carolina record based on an extant specimen (Museum of Comparative Zoology, Harvard University, MCZ 2287; Palmer & Braswell, 1995) was collected in 1871 on the French Broad River in Madison County (Brimley, 1944). Like many other specimens taken in the late 1800s, the locality data are not absolutely certain, and might be disregarded except for several additional facts. W. H. Weller (1930) reported finding this snake at Chimney Rock, Rutherford County, North Carolina. Weller (1930) noted that *O. vernalis* was rather scarce; he observed only three individuals during 1928-1930. The next species in his checklist is *Opheodrys aestivus*, which reduces the possibility that Weller may have misidentified his snakes. He apparently was able to distinguish both species and must have been familiar with *O. vernalis* in his home state of Ohio. R. L. Hoffman (pers. comm.) personally identified two road-killed *O. vernalis* in 1952 along the Blue Ridge Parkway, both near Mount Mitchell, Yancy County, NC. Palmer & Braswell (1995) do not include a full species account, citing a need for valid museum specimens. Walley (2003) does not include these North Carolina historic records in his review.

There are only four separate historical localities known for this species in western North Carolina. Any one of these alone could probably be discounted (e.g., as escapees from automobiles or pet containers, especially at summer camps). These observations, information in the literature, and the museum record suggest that Smooth Greensnakes were present in parts of the southern Appalachians (although apparently not as far south as the Great Smoky Mountains), but already declining and rare by the middle of the 20th century. That none has been reported in North Carolina since 1952, despite intensive biological collecting throughout the Appalachians, would seem to represent a requiem for *O. vernalis* farther south than the latitude of about Roanoke, Virginia.

## OTHER SOUTHERN APPALACHIAN "RECORDS"

A putative *O. vernalis* from a lumberyard in northern Georgia was collected in the mid to late 1980s by a student of Dr. Kenneth Fahey and brought in alive to Brenau College, Gainesville, Georgia. Dennis Herman (pers. comm.) saw the snake before it was preserved. Dr. Fahey (pers. comm.) still has the specimen and will donate it to the North Carolina

Museum of Natural Sciences. Fahey dismissed the find as having come in on a shipment of lumber, and noted that several searches of the area revealed no additional specimens (D. Herman, pers. comm.). The validity of the record remains in doubt.

## DISCUSSION AND CONCLUSIONS

Lack of observations of *O. vernalis* by R. L. Hoffman (pers. comm.) during the past four decades in western Virginia, the fact that no additional specimens have been taken at the Mountain Lake Biological Station for over five decades (H. Wilbur, University of Virginia, pers. comm.), and the apparent extirpation of this species in North Carolina suggest that populations of this snake may have declined and its range contracted in the southern portion of its range during the past century. That no additional specimens have been reported from North Carolina suggests that the Smooth Greensnake may be extirpated from the southernmost region of the Appalachians. The putative *O. vernalis* from Georgia must be discounted due to lack of information on an extant population. The recent Floyd County, Virginia, report (First, 2005) is the only known locality south of the James River in the Blue Ridge Mountains. The three localities in Bland and Giles counties are the only ones known south of the New River. Whether they represent healthy or declining populations is unknown.

One may invoke the factor of post-Pleistocene climate warming and northward retreat of plants and animals to explain the apparent range contraction of *O. vernalis* in the southern Appalachians. Historical landscape changes caused by humans may have also played a role. Clearing of forests by American Indians and colonists, as well as natural forest dynamics, created open areas colonized by grasses, especially in the mountains. Such habitats are favored by *O. vernalis* in high elevations, as they are currently found in some numbers in mountain balds and sites like Big Meadows in Shenandoah National Park.

The information summarized in this contribution may be interpreted as consistent with an ongoing, progressive decline of a snake species in the extreme southeastern portion of its former range. Searches for this snake should be made in all of the southwestern counties south of the New River to determine its current status in this region. Perhaps there are unreported new county records to be found. Reports of all observations, preferably with a voucher photograph or collections of road-kills and other specimens, should be placed in museums and published in the scientific literature so that future reviews of range contraction in this species can achieve a higher level of accuracy than possible

here. The conservation status of *Opheodrys vernalis* in Virginia should also be reviewed through field verification of all of the above known localities to determine if they still support populations. Such knowledge is the only way to effectively assess the true status of this high elevation snake in Virginia and the southern Appalachian portion of its range.

Conservation efforts on behalf of *O. vernalis* should consist of maintaining high elevation grasslands and control of encroachment by woody vegetation. Prescribed burns should be conducted on a regular basis by George Washington and Jefferson National Forest biologists and fire managers at all known grassland sites over 0.3 ha (1 acre) in size or larger. Prescribed fire has been used effectively in Big Meadows in SNP to maintain the open grassland vegetation (Cocking et al., 1976; Otto et al., 1977). This form of management should continue at this important location. Consideration should be given by National Park Service biologists to the use of mechanical tree removal and prescribed fire in previously known *O. vernalis* locations to enhance population growth and movement among sites in SNP. Private landowners in mountainous regions could contribute to this effort by allowing searches for this snake and by using prescribed fire as a tool to maintain their grassland habitats.

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#### LITERATURE CITED

- Akre, T. S. B. 2003. Geographic distribution: *Opheodrys vernalis*. *Herpetological Review* 34: 389.
- Akre, T. S. B., & T. F. Robison. 2003. Geographic distribution: *Opheodrys vernalis*. *Herpetological Review* 34: 389.
- Brimley, C. S. 1944. *Amphibians and reptiles of North Carolina*. Carolina Biological Supply Company, Reprinted from *Carolina Tips* 1939-1943, Burlington, NC. 63 pp.
- Brown, W. S. 1993. Biology, status, and management of the timber rattlesnake (*Crotalus horridus*): a guide for conservation. Society for the Study of Amphibians and Reptiles, *Herpetological Circular* 22: 1-78.
- Cocking, W. D., E. E. Baxter, & S. L. Lilly. 1976. Plant community responses to the use of prescribed burning as an alternative to mowing in the management of Big Meadows, Shenandoah National Park. Pp. 1205-1207 *In* R.M. Linn (ed.), *Proceedings of the First Conference on Scientific Research in the National Parks*. Volume 2, Number 5. New Orleans, LA.
- Conant, R., & J. T. Collins. 1998. *A Field Guide to Reptiles and Amphibians of Eastern and Central North America*. Third, expanded edition. Houghton Mifflin Co., Boston, MA. 650 pp.
- Cope, E. D. 1900. The crocodilians, lizards, and snakes of North America. Report of the U.S. National Museum 1898: 153-1294.
- Dunn, E. R. 1918. A preliminary list of the reptiles and amphibians of Virginia. *Copeia* (53): 16-27.
- Dunn, E. R. 1936. List of Virginia amphibians and reptiles. Haverford College, Haverford, PA, Mimeographed. 5 pp.
- First, F. B., Jr. 2005. Field notes: *Opheodrys vernalis*. *Catesbeiana* 25: 83-84.
- Green, N. B., & T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press, Pittsburgh, PA. 241 pp.
- Hoffman, R. L. 1945. Notes on the herpetological fauna of Alleghany County, Virginia. *Herpetologica* 2: 199-205.
- Hoffman, R. L. 1986. The herpetofauna of Alleghany County, Virginia Part 3: Class Reptilia. *Catesbeiana* 6: 4-9.

- Hoffman, R. L., & J. C. Mitchell. 1994. Paul R. Burch's herpetological collection at Radford College, Virginia: a valuable resource lost. *Catesbeiana* 14: 3-12.
- Linzey, D. W. 1959. Further records of the smooth green snake in the Virginia Blue Ridge Mountains. *Herpetologica* 15: 94.
- Linzey, D. W., & M. J. Clifford. 1981. Snakes of Virginia. University Press of Virginia. Charlottesville, VA. 159 pp.
- Martin, W. H., & D. B. Means. 1999-2000. Distribution and habitat relationships of the eastern diamondback rattlesnake (*Crotalus adamanteus*). *Herpetological Natural History* 7: 9-34.
- Meylan, P. A. 1982. The squamate reptiles of the Inglis IA fauna (Irvingtonian: Citrus County, Florida). *Bulletin of the Florida State Museum of Biological Sciences* 27: 1-85.
- Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, D.C. 352 pp.
- Mitchell, J. C., & K. K. Reay. 1999. Atlas of Amphibians and Reptiles of Virginia. Special Publication No. 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.
- Otto, R. A., J. C. Neiss, & P. L. Dalby. 1977. Fire ecology at Big Meadows. *Virginia Wildlife* 38(August): 6-7.
- Palmer, W. M., & A. L. Braswell. 1995. Reptiles of North Carolina. University of North Carolina Press, Chapel Hill, NC. 412 pp.
- Roberts, A., & J. Tickle. 2004. Field notes: *Opheodrys vernalis* (Smooth Greensnake). *Catesbeiana* 24: 72-73.
- Timmerman, W. W., & W. H. Martin. 2003. Conservation guide to the eastern diamondback rattlesnake. Society for the Study of Amphibians and Reptiles, Herpetological Circular 32: 1-55.
- Tobey, F. J. 1985. Virginia's Amphibians and Reptiles, A Distributional Survey. Virginia Herpetological Survey, Virginia Herpetological Society, Purcellville, VA. 114 pp.
- Uhler, F. M., C. Cottam, & T. E. Clarke. 1939. Food of snakes of the George Washington National Forest, Virginia. Transactions of the Fourth North American Wildlife Conference, Washington, DC. 1939: 605-622.
- Walley, H. D. 2003. *Liochlorophis*, *L. vernalis*. Catalogue of American Amphibians and Reptiles 776: 1-13.
- Weller, W. H. 1930. Records of some reptiles and amphibians from Chimney Rock Camp, Chimney Rock, N.C., and vicinity. *Proceedings of the Junior Society of Natural Sciences* 1: 51-54.
- Witt, W. L. 1958. The smooth green snake in the Virginia Blue Ridge Mountains. *Herpetologica* 14: 140.
- Witt, W. L. 1963. Distributional notes on some Virginia reptiles. *Proceedings of the Biological Society of Washington* 76: 305-306.
- Witt, W. L. 1993. Annotated checklist of the amphibians and reptiles of Shenandoah National Park, Virginia. *Catesbeiana* 13: 26-35.
- Wright, A. H., & A. A. Wright. 1952. List of the snakes of the United States and Canada by states and provinces. *American Midland Naturalist* 48: 574-603.
- Yarrow, H. C. 1882. Descriptions of new species of reptiles and amphibians in the United States National Museum. *Proceedings of the U.S. National Museum* 5: 348-344.
- Young, D. A. 1993. An annotated checklist of reptiles and amphibians from Highland County, Virginia. *Catesbeiana* 13: 3-8.

## Ecology of a Salamander Assemblage, Including Disjunct Populations of *Eurycea lucifuga* and *E. l. longicauda*, in an Abandoned Virginia Mine

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### ABSTRACT

An ecological study on salamanders in an abandoned mine near Riverville, Amherst County, Virginia was conducted throughout 2000. Species found in this mine included *Eurycea lucifuga*, *E. l. longicauda*, *E. guttolineata*, *Plethodon cylindraceus*, and *Pseudotriton r. ruber*. This location represented county records, as well as range extensions of approximately 60 km, for *E. lucifuga* and *E. l. longicauda*. Almost 50% (n = 31) of the salamanders found were *E. guttolineata*. Six *E. lucifuga* and four *E. l. longicauda* were also found. Most salamanders were found during two time periods: April through June and August through November. Larval *Eurycea* in a pool in the mine declined from a high of 25 to 0 over the course of the study and may have been prey of *P. r. ruber* larvae and crayfish. Long-term survival of the sparse, disjunct populations of *E. lucifuga* and *E. l. longicauda* in this mine remains to be determined.

*Key words:* cave ecology, disjunct population, *Eurycea longicauda*, *Eurycea lucifuga*, salamander.

### INTRODUCTION

We found three species of salamanders in the genus *Eurycea* in an abandoned mine near Riverville, Amherst County, Virginia during field trips by the Liberty University ecology class in 1999. The species included the Cave Salamander (*Eurycea lucifuga*), Long-tailed Salamander (*E. l. longicauda*), and Three-lined Salamander (*E. guttolineata*). These findings represented new county records, as well as range extensions of approximately 60 km, for *E. lucifuga* and

*E. l. longicauda*. The new location is in the Piedmont physiographic region, whereas all other Virginia locations for these two species are from the Ridge and Valley and Blue Ridge Mountain physiographic regions (Mitchell & Reay, 1999). The Piedmont locality extends the distribution for Long-tailed Salamanders into an area typically occupied by Three-lined Salamanders.

Initial findings on this abandoned mine were reported by Reichenbach et al. (2000). This report details our findings of a one-year study on the ecology of the three *Eurycea* and two other species of salamanders found in this mine.

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## STUDY SITE

The mine is in the Piedmont physiographic region near Riverville, Amherst County, Virginia (37° 31' 52.7" N, 78° 53' 59.4" W). Based on conversations with long-term residents of this area, the mine was active in the mid- to late-1800s, copper or iron was extracted, and it was likely abandoned by 1920. The mine entrance faces east and is about 1 m high by 2 m wide. It opens into one 88 m main horizontal channel into the side of a hill. The main channel is about 3 m high and wide. Water often drips from the ceiling and stalactites are developing. Fissures in the rock walls are only found in the first 15 m of the main channel. There are two horizontal side channels 31 m from the entrance. One channel extends 24 m and the other channel is 5 m long. A ventilation shaft appears to have been started in the area where the side channels are located. There is a spring at the back of the mine in addition to one in the back of the longer of the two side channels. The spring in the back of the main channel was seen flowing during all trips to the mine while the side channel spring was dry in December 2000. There are three pools in the mine, one large and two small, all located beyond the twilight zone which extends 10 m into the mine. The largest pool (20 cm depth, silt substrate with five small, submerged rocks at the end of the pool) extends 15-25 m along the main channel, a smaller pool (1 m<sup>2</sup>, 5 cm depth, silt substrate) is located at the back of the mine, and another small pool (5 cm depth, rocky substrate) is at the beginning of the longer of the two side channels. Water temperature and pH of the large pool were measured in March 2000, and were 13°C and 6.4, respectively. Temperature and relative humidity were recorded with a Protimeter digital hygrometer ( $\pm 2\%$  accuracy) 1 m outside the entrance of the mine, 1 m inside the entrance to the mine, at the intersection of the two side channels and the main channel (31 m into the mine) and at the rear of the main channel at 88 m. Temperature and relative humidity at the four locations averaged ( $\pm 1$  SD,  $n = 20$ ) starting from the entrance  $23 \pm 4$ ,  $20 \pm 4$ ,  $18 \pm 3$ ,  $18 \pm 2$  °C and  $50 \pm 18$ ,  $58 \pm 15$ ,  $63 \pm 9$ ,  $67 \pm 5$  %, respectively.

Other organisms found throughout the year in the terrestrial part of the mine included wolf spiders (Arachnida, Lycosidae), pillbugs (Isopoda), centipedes (Chilopoda), and cave crickets (Insecta, Rhaphidophoridae). Crayfish (*Cambarus bartonii*) were found in the large pool and small pool in the longer side channel. Little Brown Bats (*Myotis lucifugus*), Pickerel Frogs (*Rana palustris*), Wood Frogs (*Rana sylvatica*), and Eastern Rat Snakes (*Elaphe alleghaniensis*) used the mine primarily as a hibernaculum.

## METHODS

We used a rope, marked off in 1 m intervals, for measuring salamander capture locations in the mine. One rope was placed along the floor of the main channel of the mine and two other ropes were placed along the floor of the two side channels. A bridge was constructed over the large pool: multiple 4 m long boards roped to concrete blocks placed in the water. This bridge allowed us to look for larval salamanders without disturbing the sediment on the bottom of the pool.

Twenty-one trips were taken to the mine throughout 2000 with at least one trip being conducted during each month. We searched for salamanders using flashlights. Rocks were sometimes turned over but an effort was made to minimize disturbance to salamander habitat. Salamanders collected were measured for total length (TL) and snout-vent length (SVL), with an apparatus similar to that described by Wise & Buchanan (1992). Before measuring larval salamanders, each was anesthetized with 0.33g/L solution of MS-222 fish anesthesia (K. Mallory, pers. comm.). Salamanders were also uniquely marked. Initially, we toe-clipped the animals, and then on 3 May 2000, we started applying permanent marks with a fluorescent elastomer (Northwest Marine Technology, Inc., www.nmt-inc.com). Elastomer was injected in various locations on the salamander (limbs, base of limbs, base of tail) with each location corresponding to a unique number. We recorded capture location as the distance from the entrance of the mine and whether animals were found on the floor, walls or ceiling of the mine. All collected salamanders were processed in the mine within one-half hour of capture and were released at their capture location.

Observations (detected or not detected) on cave crickets (Family Rhaphidophoridae) were recorded in spring, summer, and fall. We examined four areas: the main channel in front of the pool, the area around the main channel pool, the two side channels, and the main channel from the side channels to the end of the main channel.

## RESULTS

The most commonly observed species in the mine was *Eurycea guttolineata* ( $n = 15$ ; Table 1). The number of individual *E. l. longicauda*, *E. lucifuga*, and *Pseudotriton r. ruber* seen was similar, ranging from four to six. Only one *Plethodon cylindraceus* was found (September 2000 and thereafter found on two subsequent field trips).

Table 1. Number of salamanders ( $n = 31$ ) observed during 2000 in an abandoned mine in Amherst County, Virginia (recaptures not included).

Species	Number observed
<i>Eurycea lucifuga</i>	6
<i>Eurycea l. longicauda</i>	4
<i>Eurycea guttolineata</i>	15
<i>Pseudotriton r. ruber</i>	5
<i>Plethodon cylindraceus</i>	1

Most of the salamanders collected were found during two time periods, April through June and August through November (Fig. 1). All of the species followed this general pattern. Before July, 15 of 16 salamanders were found in the front area of the mine from what was designated as the 'intersection' forward (entrance to 31 m into the mine). This distribution was similar to that found for the cave crickets. After July, salamanders were more evenly distributed (12 salamanders in the front and 8 in the back), while the crickets remained in the front of the mine.

Six *E. lucifuga* were captured with one recapture. SVLs ranged from 55 to 69 mm and TLs from 115 to 159 mm. The average distance they were found into the mine was  $20 \pm 12$  m (mean  $\pm 1$  SD). Individuals were seen in fissures in the mine wall, as well as among the rocks on the floor of the front portion of the mine.

Four *E. l. longicauda* were captured with two recaptures. SVLs ranged from 42 to 64 mm and TLs from 110 to 156 mm. The average distance they were found into the mine ( $11 \pm 10$  m) was not significantly different from that of *E. lucifuga* ( $t = 1.9$ ,  $df = 7$ ,  $P = 0.24$ ). As with *E. lucifuga*, *E. l. longicauda* were seen in fissures in the mine wall, as well as along the floor of the mine.

Fifteen *E. guttolineata* were captured with three recaptures. SVLs ranged from 45 to 78 mm and TLs from 100 to 167 mm. Average distance they occurred in the mine was  $34 \pm 25$  m from the entrance. Individuals were found primarily on the floor of the mine and they occurred throughout the mine. Of the 15 unique individuals collected, five had the typical *E. l. longicauda* herringbone tail pattern and light venter. These five individuals were recorded as *E. guttolineata* based upon Carlin's (1977) criterion of the ratio of the length of the two longest mid-dorsal stripes divided by the SVL being greater than 0.8.

Two adult *P. r. ruber* were found multiple times within 1-2 m of each other at the intersection region of the mine. The larger one (SVL 78) was likely a female and the smaller one (SVL 64) a male (Petranka, 1998). The three other Northern Red Salamanders that were caught ranged from 37 to 55 mm SVL. These smaller individuals were observed from August to October and appeared to have recently undergone metamorphosis.

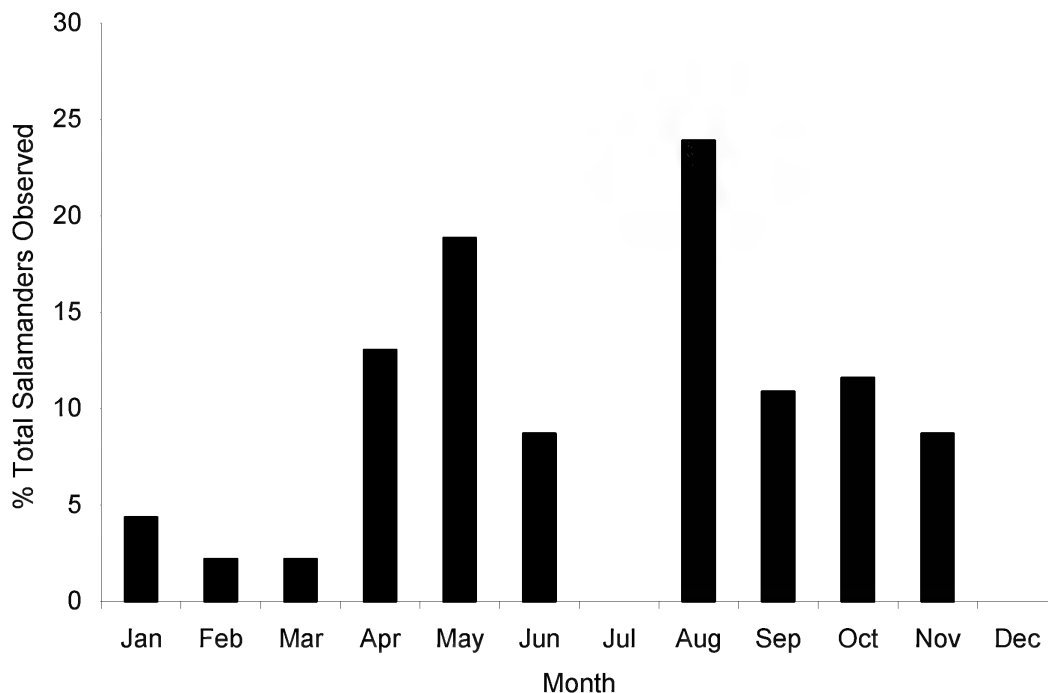


Fig. 1. Monthly variation in percent total salamanders observed in an abandoned mine in Amherst County, Virginia ( $n = 52$ ).



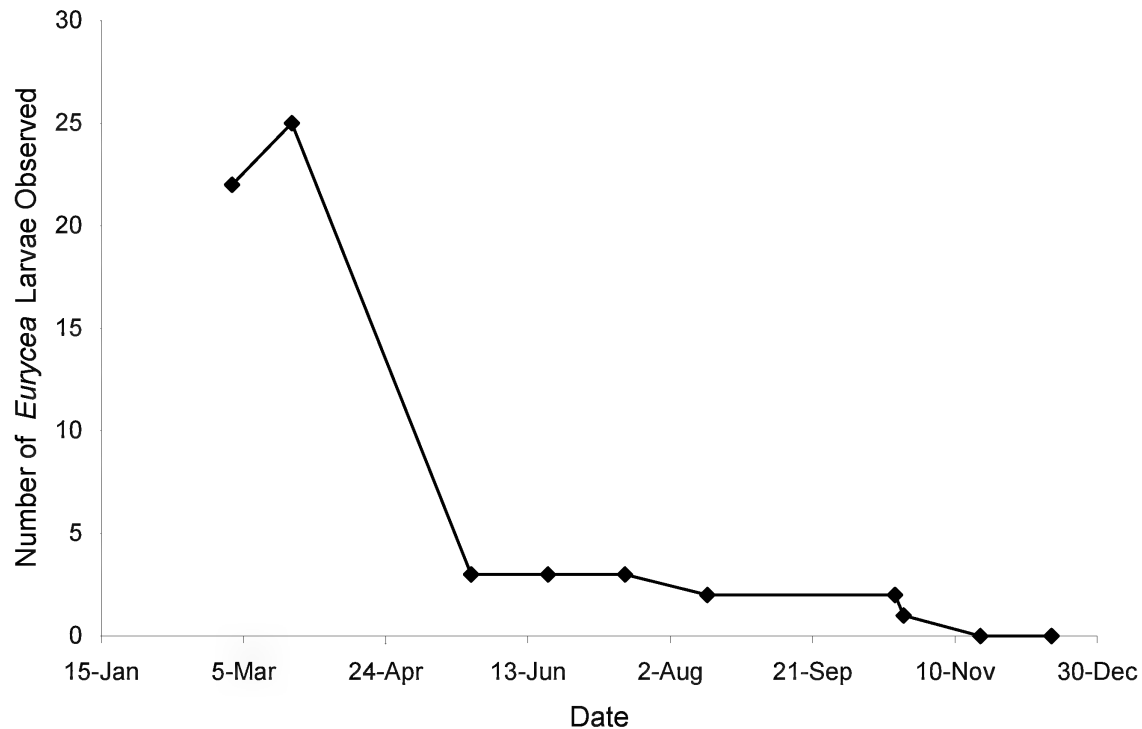


Fig. 2. Number of larval *Eurycea* found between March and December 2000 in an abandoned mine in Amherst County, Virginia.

All *P. r. ruber* were found on the floor of the mine from the intersection towards the back of the mine, at an average distance of  $41 \pm 15$  m from the entrance. We caught seven large larvae (SVL 42–48 mm; TL 65–90 mm) in addition to the adult and recently metamorphosed Northern Red Salamanders.

Larvae of *E. lucifuga* and *E. longicauda* complex (*E. l. longicauda* and *E. guttolineata*; Petranks, 1998) were first seen on 2 February 2000. Seven *Eurycea* larvae measured on 22 March 2000 had an average TL of  $21 \pm 3$  mm. The number of *Eurycea* larvae declined over time and none were seen during the last two trips in November and December (Fig. 2).

The entire tail or the tip of the tail was missing for three adult salamanders (two *E. guttolineata*, one *E. l. longicauda*). Two were found by the large pool in the main channel where most of the crayfish were found.

## DISCUSSION

The spring peak in activity follows that found by Hutchinson (1958) and appears, at least for the Cave Salamander, to be related to salamander emergence from deep crevices occupied during winter months. Most of these salamanders were found in the front half

of the mine where they may have been feeding on cave crickets since Orthoptera are known dietary items for Cave and Long-tailed salamanders (Anderson & Martino, 1967; Hutchinson, 1958). Our second activity peak was in late summer and early fall. This peak, along with a more even distribution of salamanders in the mine with some being around the pool, may be associated with fall breeding/egg laying activity for the *Eurycea* species (Petranks, 1998). Changes in the abundance of *E. l. longicauda* have been related to migration out of a Pennsylvania cave in the spring and then back again just before winter (Mohr, 1944). We found no evidence for this type of migration. Three times during summer and fall we examined an area to a distance of 10 m from the mine entrance without finding any salamanders.

Hutchinson (1958) found a negative correlation between numbers of *E. lucifuga* and *E. l. longicauda* and suggested that this might be due to interspecific competition. Our data indicate that both species were found primarily in the front part of the mine where there were numerous fissures in the rock wall. Average capture location distances from the mine entrance for the two species were not significantly different and hence our data do not support the view that the presence

of one species has a negative effect on the other species.

While *E. l. longicauda* and *E. lucifuga* are commonly found in caves and abandoned mines, the other species seen in this mine are not associated with subterranean habitats (Petranka, 1998). *Eurycea l. longicauda* has been found in large numbers (100s) in a mine similar to the one for this study (Mohr, 1944). *Eurycea lucifuga* populations are typically smaller, ranging from 36 to 63 per cave (Hutchinson, 1958). In this study, populations of *E. lucifuga* and *E. l. longicauda* appear to be sparse without recruitment in 2000. A cohort of recently metamorphosed individuals is lacking as evidenced by the TLs for salamanders caught being within the adult size range for these species (100-200 mm; Petranka, 1998). The lack of recruitment may be due to larval mortality as evidenced by declines in the number of *Eurycea* larvae seen over time (Fig. 2). Mortality may be due to a) predation by large *P. r. ruber* larvae (65-90 mm TL) which may be 3+ years in age (*P. r. ruber* are known to prey on small amphibians; Petranka, 1998), b) predation by crayfish ( $\leq 12$  cm rostrum to uropod length) which have been known to prey on larval salamanders (Myers, 1958), and c) starvation since common prey items for larval *Eurycea* such as snails, fly larvae, isopods, beetles, and mayfly nymphs (Rudolph, 1978) were never observed in the mine pools (larvae seen from February to October were similar in size to those measured in March). How and when *E. lucifuga* and *E. l. longicauda* colonized the mine is unknown and how long their sparse populations without recruitment can persist remains to be determined.

#### ACKNOWLEDGMENTS

We thank Kelvin and Sarah Mays for allowing us to conduct our study in the mine located on their property. We also thank Monte A. McGregor for identifying the species of crayfish found in the mine. We thank other students who participated in the field activities including Nate, Summer, Jonathan, Doug, Betsy and the 1999 and 2000 Liberty University Ecology classes. The study was supported in part by a grant from the Virginia Department of Game and Inland Fisheries.

#### LITERATURE CITED

- Anderson, J., & P. Martino. 1967. Food habits of *Eurycea longicauda longicauda*. *Herpetologica* 23: 105-108.
- Carlin, J. 1997. Genetic and morphological differentiation between *Eurycea longicauda longicauda* and *E. guttolineata* (Caudata: Plethodontidae). *Herpetologica* 53: 206-217.
- Hutchinson, V. 1958. The distribution and ecology of the Cave Salamander, *Eurycea lucifuga*. *Ecological Monographs* 28: 1-20.
- Mitchell, J. C., & K. K. Reay. 1999. Atlas of amphibians and reptiles in Virginia. Special Publication No. 1, Virginia Department of Game and Inland Fisheries, Richmond, VA. 122 pp.
- Mohr, C. 1944. A remarkable salamander migration. *Proceedings of the Pennsylvania Academy of Science* 18: 51-54.
- Myers, C. 1958. Amphibia in Missouri caves. *Herpetologica* 14: 35-36.
- Petranka, J. W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, DC. 587 pp.
- Rudolph, D. 1978. Aspects of the larval ecology of five plethodontid salamanders of the western Ozarks. *American Midland Naturalist* 100: 141-159.
- Reichenbach, N., & the 1999 Liberty University Ecology Class. 2000. Syntopic occurrence *Eurycea lucifuga* (Cave Salamander), *E. longicauda longicauda* (Long-tailed Salamander), and *E. guttolineata* (Three-lined Salamander) in the Piedmont of Virginia. *Catesbeiana* 20: 32-33.
- Wise, S., & B. Buchanan. 1992. An efficient method for measuring salamanders. *Herpetological Review* 23: 56-57.

## The Volvating Scarabaeid Beetles of Virginia (Coleoptera: Scarabaeidae: Ceratocanthinae)<sup>1</sup>

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### ABSTRACT

All three North American species of the scarabaeid subfamily Ceratocanthinae are reported from Virginia, two of them for the first time. *Germarostes globosus* is widespread at low elevations, *G. aphodioides* is documented only for the far southwestern end of the state, and *Ceratocanthus aeneus* (new northernmost record) only for Virginia Beach. An identification key and drawings of diagnostic characters are provided.

*Key words:* beetles, Ceratocanthinae, Coleoptera, distribution, Scarabaeidae, Virginia, volvation.

Almost every group of organisms contains species which have become so modified in body form that any obvious indication of their actual relationships is effectively concealed. This phenomenon is particularly engaging when the constituent group is relatively uniform in appearance and generally recognized by some vernacular name. A case of this sort in the Virginia insect fauna is demonstrated by three local members of the genera *Ceratocanthus* and *Germarostes*, which have departed from the familiar scarab image by their adaptation to a nearly spherical body form.

Volvation as a means of protection (or water conservation) has evolved in a number of animal groups (armadillos, isopods, millipeds, beetles), and this capability has been achieved by several different structural modifications. In some beetles, such as *Agathidium oniscoides* (Leiodidae), the entire forebody hinges back against the strongly convex elytra, with legs and antennae hidden inside the marginal seam formed by the juxtaposed pronotal and elytral edges. *Ceratocanthus aeneus* also achieves a globular shape by partially reflexing its forebody ventrad, but uses the broadened

tibiae of the middle and rear legs as visible external elements in the closure, in a highly singular adaptation (Fig. 1).

The great majority of known ceratocanthid species and genera are tropical in distribution; only two genera and three species, all of them native to Virginia, are represented in the United States. In addition to not looking like typical scarabs, ceratocanthids are underrepresented in collections, and appear to be found largely by serendipity. Perhaps this situation can be improved when we know more about their preferred habitats and way of life. Some species of *Ceratocanthus* are stated by Gill & Howden (2000) to feed at night on fungi growing on rotting logs; perhaps our local species might also be sought in light of such information.

### Key to the North American genera and species of Ceratocanthinae

1. Body capable of enrolling into a compact sphere; elytral striae represented over most of surface only by series of minute punctures; posterior corner of pronotum broadly rounded (Fig. 3), its entire surface smooth and impunctate ..... *Ceratocanthus aeneus*
- Body capable of forming an elongated subcylindrical form only; elytral striae represented by series of elongated short grooves; posterior corners of pronotum right-angled (Fig. 5, 6), surface punctate ..... 2

<sup>1</sup>Up until about 1970 this group occurred in the literature under the names Acanthocerinae or Acanthoceridae. Since the actual ranking of the group has been perceived in different ways, it has appeared in more recent literature as Ceratocanthini or Ceratocanthinae in either Scarabaeidae or Hybosoridae, or as a discrete family Ceratocanthidae. Until the currently fluctuant classification of scarabaeids has achieved some level of stability, I prefer to observe the traditional (pre-2000) nomenclature that is still followed by some conservative scarab specialists.

2. Lateral edge of elytra (epipleuron) tuberculate-serrate (best seen in dorsal aspect); front of head with fine striations arranged in transverse rows or concentric ("fingerprint") pattern; pronotum (Fig. 5) with a sharply-defined, deep groove adjacent to anterior, lateral, and posterior edges; anterolateral corner of pronotum acutely prolonged, subtending ventral margin of eye.....*Germarostes globosus*

– Lateral edge of elytra smooth; striations on front of head not concentric; pronotum (Fig. 6) with submarginal groove only behind front edge; anterolateral corner of pronotum only slightly rounded behind eye, not subtending it.....*Germarostes aphodioides*

### **Ceratocanthus**

This exclusively New World genus (formerly known as *Acanthocerus*) is most speciose in South America, whence over 40 species have been described. Only one extends as far north as southern United States, where it is the least frequently collected of our three endemic species.

#### ***Ceratocanthus aeneus* (MacLeay) (Figs. 1-4).**

New state and northernmost record

As noted by Woodruff (1973), this species is one of the least collected of American scarabaeoids, estimated by him to be represented by fewer than 15 specimens in all collections at that time. The range known to Woodruff included United States south of North Carolina and Tennessee. It is now possible to extend this area slightly northward on the basis of two recently-collected specimens.

*City of Virginia Beach:* First Landing/Seashore State Park, 23 June - 6 July 2003, Robert Vigneault (VMNH 2). This locality is 310 km (192 miles) northeast of Southern Pines, N.C., where recorded by Brimley (1938).

However, the insect collection at NCSU has a single specimen of *C. aeneus*, collected by Tom Daggy during July 1980 in Iredell County [without further locality], North Carolina. This county is slightly north of Southern Pines; its location in the western Piedmont demonstrates that the species is not restricted to the Coastal Plain and may be found in the Piedmont region of Southside Virginia.

Of the three Virginia ceratocanthids, *C. aeneus* is most completely modified for volvation, its forebody larger and hindbody more convex than in the species of *Germarostes*. When the animal is enrolled, the flattened tibiae are incorporated as integral units of the sphere, with their truncate distal edges making a complete midventral contact and the posterior edge of pro- and mesotibiae

overlapping the anterior edge of the tibiae following (Fig. 2). The antennae are entirely concealed by the protibiae and lateral end of the pronotum. The meso- and metatarsi are hinged to lie back against the inner tibial surface (Fig. 4), and protarsi are retracted into the midventral space closed by the mesotibiae.

Woodruff (1973) reported captures by beating dead vines in Florida. A more precise biotope was described by Choate (1987): a basal cavity in a floodplain tree in Liberty County, Florida, that contained both adults and immature stages. Such tree holes are apparently primarily developmental sites, as adults were sometimes not present, and were noted to vacate the hole after merging from their pupal stage (early June in Florida). If adults resort to flowers for feeding, they have apparently not been specifically captured at such resource sites. Choate (1987) observed that adults fly readily and effectively, and surmised that canopy-flowering plants might be implicated. But perhaps like other ceratocanthids they normally feed upon fungi.

The specimens from Virginia Beach were taken by general beetle techniques (e.g., beating, de-barking, etc.) and the collector did not individualize the precise habitat of small nondescript species.

### **Germarostes**

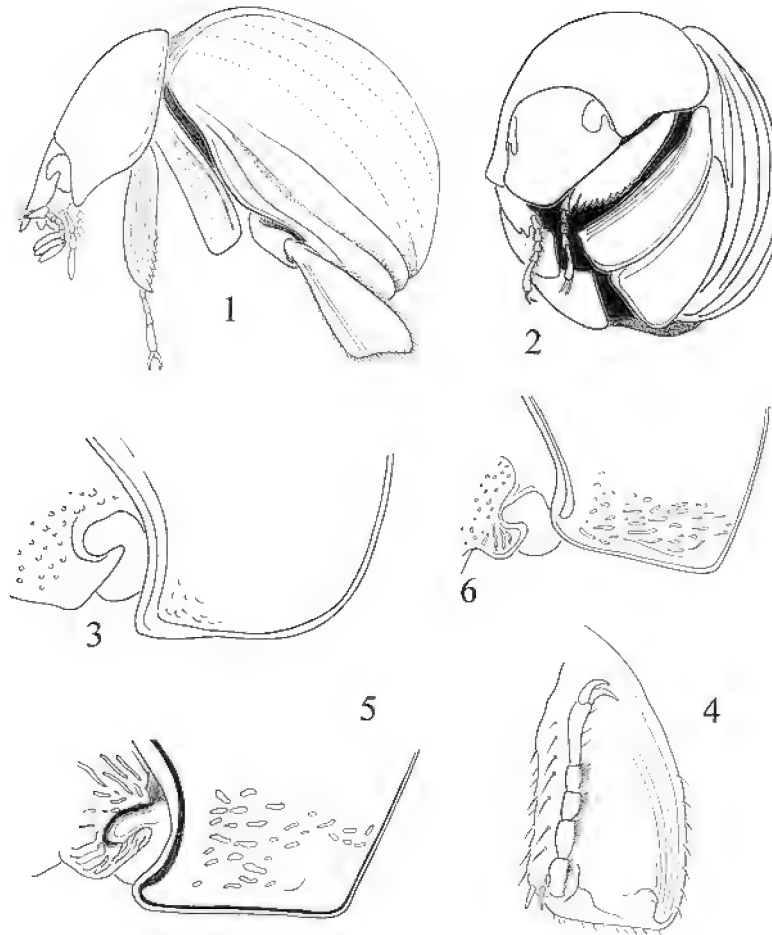
Prior to 1980, this genus appeared in American literature (e.g., Woodruff, 1973) under the name *Cloeotus*. *Germarostes*, proposed by R. Paulian (1982) to accommodate North American species, has found universal acceptance in recent literature.

In this genus the body form is relatively elongated, and as a result, even though the forebody (head and thorax) folds back upon the ventral side of the hindbody and the tibiae are flattened and enlarged to help close a ventral cavity, the effect is more compressed-oviform or lenticular than the nearly spherical form assumed by *Ceratocanthus*.

#### ***Germarostes globosus* (Say) (Figs. 5, 7).**

As currently defined, this species occupies an extensive range: from Pennsylvania and Illinois southward through much of South America. In Virginia, it appears to occur statewide at low elevations, although the majority of records are for the Coastal Plain and eastern Piedmont (Fig. 7).

VMNH has material from Appomattox, Bath, Brunswick, Dickenson, Dinwiddie, Essex, Fairfax, Greenville, Halifax, Isle of Wight, Lee, and Prince William counties, and the cities of Suffolk and Virginia Beach. All of the 33 specimens were collected between mid-May and early July, most of them having been



Figs. 1-6: Fig. 1. *Ceratocanthus aeneus*, lateral aspect of "unrolled" specimen with the hindleg pulled out of the reflexed position assumed by the front and midlegs. Fig. 2. *C. aeneus*, oblique anteroventral view of specimen in which the truncate ends of the tibiae are not completely in contact and tarsi of front legs are visible. In complete enrollment all of the edges surrounding the space shown in black would be in tight contact. Fig. 3. *C. aeneus*, lateral aspect of pronotum and ocular region of head. Fig. 4. *C. aeneus*, inner surface of tibia of rear legs, with tarsi shown in their normal retracted position. Fig. 5. *Germarostes globosus*, lateral aspect of pronotum and ocular region of head, showing complete submarginal groove (black). Fig. 6. *G. aphodioides*, lateral aspect of pronotum and ocular region. Figs. 1 and 2 drawn to same scale, figs. 3-6 to same scale but enlarged.

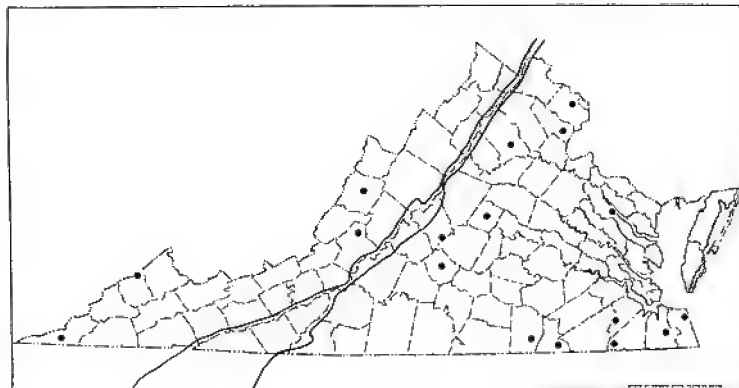


Fig. 7. Distributional records for *Germarostes globosus* in Virginia. Capture sites in the western-most counties are discussed in the text. The Blue Ridge is indicated by the outlined oblique area.

attracted to UV lights. USNM specimens add the counties of Botetourt, Culpeper, Fluvanna, and Nelson, and the City of Chesapeake, and one extends the season of adult activity into September.

The localities in Bath County (Cowpasture River at Rt. 629 bridge, 6.4 km N of Millboro Springs, 9 June 1999, S. M. Roble) and Botetourt County (8 km SSE of Clifton Forge, May 1982, W. E. Steiner) would at first appear to be disjunct from the bulk of the species' range in Virginia (Fig. 7), but many "austral" or lowland species are known to follow the floodplains of large rivers far into western Virginia, and *G. globosus* may correspond to this pattern.

Localities in Dickenson and Lee counties are consistent with an austral ("Carolinian") distribution pattern which extends northward both east and west of the southern Appalachians.

### ***Germanostes aphodioides* (Illiger) (Fig. 6).**

New state record

The documented range of this species is extensive: generally south of a line drawn between the District of Columbia, and Illinois (Woodruff, 1973, fig. 397) but more recently recorded also from southeastern Nebraska (Ratcliffe, 1991) and southern Ontario (Howden, 1992). It may occur statewide in Virginia, but the only specimens examined are from the extreme southwestern end of the state, adjacent to the Kentucky border.

*Lee Co.*: Cedars Natural Area Preserve, ca. 10 km SW of Jonesville, limestone barren, 25 May 2002, C. S. Hobson (VMNH 1). *Dickenson Co.*: Breaks Interstate Park, 10 km N of Haysi, 1-14 July 2000, Robert Vigneault (VMNH 1).

Harpootlian (2001) cited *G. aphodioides* only from Clemson and Greenville in westernmost South Carolina. Brimley (1938) did not list the species, and I am not aware of any published records for North Carolina. It is therefore desirable to confirm its presence there from two specimens in the NCSU collection. *Mecklenburg Co.*: Davidson, 26 April 1954, T. Daggy (1). *Wake Co.*: Raleigh, 7 June 1980, D. L. Stephan (1). Since Raleigh is on the Fall Line, only 50 miles south of Virginia, it seems probable that *G. aphodioides* will be found in central or eastern areas of this state, confirming the old "D.C." record (Ulke, 1902) which has heretofore seemed "out of range" (if not a little suspect).

### ACKNOWLEDGMENTS

The majority of ceratocanthids in the VMNH collection were captured by staff members of the Division of Natural Heritage, Virginia Department of

Conservation and Recreation, and I am indebted to Dr. Steven M. Roble for placing them in my hands for study. The remaining specimens, including the only instate material of *C. aeneus*, were collected for the museum by Robert Vigneault (Oka, Quebec). Information about these species in the North Carolina State University collection (NCSU) was obtained through the cooperation of Dr. Lewis L. Deitz, curator, and Robert L. Blinn, collections manager. Dr. Brett C. Ratcliffe kindly provided relevant pin label data from USNM specimens on long-term loan to his laboratory at the University of Nebraska.

### LITERATURE CITED

- Brimley, C. S. 1938. The Insects of North Carolina. Being a List of the Insects of North Carolina and Their Near Relatives. North Carolina Department of Agriculture, Raleigh, NC. 560 pp.
- Choate, P. M. 1987. Biology of *Ceratocanthus aeneus* (Coleoptera: Scarabaeidae: Ceratocanthinae). Florida Entomologist 70: 301-305.
- Harpootlian, P. J. 2001. Scarab beetles (Coleoptera: Scarabaeidae) of South Carolina. Biota of South Carolina. Volume 2. Clemson University, Clemson, SC. 157 pp.
- Howden, H. F. 1992. First Canadian record of the subfamily Ceratocanthinae (Coleoptera: Scarabaeidae). The Coleopterists Bulletin 46: 273.
- Howden, H. F., & B. D. Gill. 2000. Tribes of New World Ceratocanthinae, with keys to genera and descriptions of new species (Coleoptera: Scarabaeidae). Sociobiology 35: 281-329.
- Paulian, R. 1982. Révision des Cératocanthides (Coleoptera: Scarabeoidea) d'Amérique de Sud. Mémoires de Muséum National d'Histoire Naturelle (N.S.), Séries A, Zoologie, 124: 1-110.
- Ratcliffe, B. C. 1991. The scarab beetles of Nebraska. Bulletin of the University of Nebraska State Museum 12: 1-333.
- Ulke, H. 1902. A list of the beetles of the District of Columbia. Proceedings of the United States National Museum 25: 1-57.
- Woodruff, R. E. 1973. The scarab beetles of Florida (Coleoptera: Scarabaeidae). Part I. The Laparosticti. Arthropods of Florida and Neighboring Land Areas 8: i-xi + 1-220.

## SHORTER CONTRIBUTIONS

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MARL PENNANT (*MACRODIPLAX BALTEATA*), A NEW COASTAL DRAGONFLY IN VIRGINIA – The Marl Pennant (*Macrodiplax balteata*) is a southern dragonfly that ranges north to North Carolina, west to southern California, and south to Venezuela, as well as in the Bahamas, Cuba, Dominican Republic, and Jamaica (Dunkle, 1989). Habitat is typically mineralized waters and brackish permanent pools near beaches and salt marshes, and marl ponds further inland (Dunkle, 1989; Needham et al., 2000).

Like many other “pennants,” the Marl Pennant typically hunts from perches at the tips of reeds, or twigs from near the ground to the treetops, and may occasionally feed in swarms. Females oviposit in tandem, laying eggs in open water or amongst surface weeds (Dunkle, 1989).

During a site visit to the popular Grandview Beach in Hampton, Virginia on 13 July 2006, I noticed a dragonfly that did not look familiar perching at the tips of grasses and twigs along an extensive patch of beachfront vegetation. I counted approximately 10-15 individuals, including both males and females. Without a net, I managed to bat one female out of the air with my hat, and collected the specimen for subsequent identification. Photographs were also taken (Fig. 1), and this species was later identified by Dr. Steve Roble as *Macrodiplax balteata*. This specimen represents the first known collection for Virginia.

Subsequent return visits (14 and 25 August 2006) to this southern portion of Grandview Beach, and another site just to the north, revealed additional sightings, and specimens collected (2 males, 3 females), suggesting that there is an established population using the entire length of Grandview Beach. These specimens will be housed in the collections of the Virginia Division of Natural Heritage, the U.S. National Museum of Natural History in Washington, D.C., and the Virginia Museum of Natural History in Martinsville, Virginia.

Habitat at the Grandview Beach site is similar to that described above, and includes salt marsh, open beach fringed with marsh grasses, reeds, and shrubs, and brackish pools.

Other species of Odonata noted during these surveys included *Anax junius*, *Brachymesia gravida*, *Erythemis simplicicollis*, *Erythrodiplax berenice*, *Ischnura ramburii*, *Libellula needhami*, *Pachydiplax longipennis*, *Pantala flavescens*, *Tramea carolina*, and *Tramea lacerata*.



Fig. 1. Subadult male *Macrodiplax balteata* from Grandview Beach, City of Hampton, Virginia (photo by Irvine Wilson).

It is unlikely that the Marl Pennant is restricted to Grandview Beach. Its preferred habitat is common in coastal Virginia, and additional surveys are needed to determine the status and distribution of this dragonfly in the Commonwealth.

## ACKNOWLEDGMENTS

I would like to thank Dr. Steve Roble for his assistance in identifying specimens. Maureen Dougherty and Irvine Wilson assisted with field surveys and photographic documentation.

## LITERATURE CITED

Dunkle, S. W. 1989. Dragonflies of the Florida Peninsula, Bermuda, and the Bahamas. Scientific Publishers, Washington, DC. 155 pp.

Needham, J. G., M. J. Westfall, & M. L. May. 2000. Dragonflies of North America. Scientific Publishers, Washington, DC. 939 pp.

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A NATIVE OCCURRENCE OF CAROLINA MOONSEED (*COCCULUS CAROLINUS*) IN VIRGINIA – Carolina Moonseed (*Cocculus carolinus*) is a native, scrambling, perennial vine of the largely tropical family Menispermaceae, reaching its

northeastern range limit in Virginia (Kartesz, 1999). Although it is largely herbaceous in such northern climates, plants are often woody at their base or, in the case of more southern specimens, capable of producing lengthy woody stems (Godfrey, 1988).

This paper reports the first definite occurrence of *Cocculus carolinus* in a natural habitat in Virginia. Previous reports of this species in Virginia have been limited to adventive occurrences in Albemarle, Clarke, Fairfax, Henrico, King George, and Prince Edward counties (Wieboldt, 2006). Previous observations by one of us (JFT) in the South Carolina Coastal Plain have been of presumably native occurrences in limestone or marl-influenced plant communities and bottomlands, but numerous populations of the species in that state are located in weedy habitats as well. Not surprisingly, floristic works describe a large range of occupied habitats from "...fencerows, waste places..." (Rhodes, 1997) to distinctly natural habitats such as "...rocky open woods, dolomite and limestone glades, alluvial ground..." (Kurz, 1997). Apparently, this native species has weedy tendencies but also can be found in habitats where few if any exotic species have penetrated, making the report of its presence in southwestern Virginia noteworthy.

The species was first noted for Cumberland Gap National Historical Park by Pounds et al. (1989) in a report prepared for the National Park Service. This report listed the species as a floristic component of the Park (providing only general locality data). It was assumed by the first author that this occurrence was another naturalized population. However, in 2001, during investigations of an outcropping of the Newman Limestone formation between Lewis Hollow and "The Pinnacle" on Cumberland Mountain, *Cocculus carolinus* was noted as a common component of a rocky, calcareous, woodland community at an elevation of approximately 640 m (2,100 ft).

This relatively narrow band of habitat runs generally in a northeast-southwest direction along the eastern slope of the mountain, turning more or less westward near the Kentucky-Tennessee-Virginia border. Framing this outcrop is a limestone woodland supporting numerous calciphilous plant species. Since the outcrop is rather narrow and elongated, a mixture of forest-dwelling and sun-loving herbs dominate beneath the broken canopy. Characteristic species of this habitat include *Quercus muhlenbergii*, *Q. rubra*, *Fraxinus americana*, *Juglans nigra*, *Juniperus virginiana*, *Cercis canadensis*, *Ostrya virginiana*, *Frangula caroliniana*, *Celtis tenuifolia*, *Parthenocissus quinquefolia*, *Toxicodendron radicans*, *Muhlenbergia tenuiflora*, and *Solidago sphacelata*. Plants of *Cocculus* are often seen sprawling over bedrock and boulders, and are seldom

found far from the exposed portion of the outcrop. Six plant species of restricted distribution in Virginia (*Carex purpurifera*, *Cheilanthes alabamensis*, *Eupatorium incarnatum*, *Helianthus hirsutus*, *Philadelphus hirsutus*, and *Sisyrinchium albidum*) also occupy this rocky habitat at Cumberland Gap National Historical Park. Despite timely searches, no fertile individuals of the Carolina Moonseed have been found.

The species accounts for *Cocculus carolinus* in regional floras (noted above) must necessarily describe the entire range of habitats occupied by the plant and therefore provide little insight into what "native" habitat consists of elsewhere in the United States. Using VegBank (2006), an ecological database for vegetation plot data submitted by ecologists, we were able to discern patterns among naturally occurring plant community types containing *C. carolinus* rangewide. Of the 27 association-level community types known to contain the species, 17 specifically mention calcareous, mafic, or circumneutral substrates being present, while the remainder of the communities are alluvial in nature, regardless of base status. In either case, it seems that in relatively natural habitats, the species seems to be most common in forests and woodlands with high nutrient availability.

Continued inventory of calcareous and mafic outcrops in Virginia may turn up additional native occurrences of *C. carolinus*, but given the known range of the species and the tropical affinities of the Menispermaceae, the southern and western boundaries of the state contain the most promising areas for future discoveries.

Voucher specimens of *Cocculus carolinus* from Cumberland Gap National Historical Park are listed below. Herbarium abbreviations follow Holmgren & Holmgren (1998).

#### Lee County, Virginia:

Limestone ledges west of Lewis Hollow. *L. Pounds CG84-103*, 10 September 1984 (TENN).

On ledges of outcropping limestone, 0.9-1.4 miles northeast of The Pinnacle. *J. F. Townsend 2690*, 13 September 2001, with J. C. Ludwig (Cumberland Gap National Historical Park herbarium).

Forming a tangle with *Smilax rotundifolia* and *S. bonanox* among broken limestone ledges above S-facing cliff, west of Lewis Hollow on Cumberland Mountain, 1.6 mi NE of Cumberland Gap. Elevation ca. 2000 ft. *T. F. Wieboldt #11525*, 22 September 2004, with C. E. Stevens and Chip Morgan (VPI); two other specimens to be distributed.



## LITERATURE CITED

Godfrey, R. K. 1988. Trees, Shrubs and Woody Vines of Northern Florida and Adjacent Georgia and Alabama. University of Georgia Press, Athens, GA. 734 pp.

Holmgren, P. K., & N. H. Holmgren. 1998 onwards (continuously updated). Index Herbariorum. New York Botanical Garden.

<http://sciweb.nybg.org/science2/IndexHerbariorum.asp>

Kartesz, J. T. 1999. A Synonymized Checklist and Atlas with Biological Attributes for the Vascular Flora of the United States, Canada, and Greenland. First Edition. In Kartesz, J. T., & C. A. Meacham. Synthesis of the North American Flora, Version 1.0. (CD-ROM). North Carolina Botanical Garden, Chapel Hill, NC.

Kurz, D. 1997. Shrubs and Woody Vines of Missouri. Missouri Department of Conservation, Jefferson City, MO. 387 pp.

Pounds, L., T. S. Patrick, & C. R. Hinkle. 1989. Rare plant assessment and checklist for Cumberland Gap National Historical Park. National Park Service, contract # PX-546042127. 79 pp.

Rhodes, D. G. 1997. *Cocculus*. Pp. 296-297 In Flora of North America Editorial Committee. Flora of North America North of Mexico. Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY.

Wieboldt, T. F. (Editor). 2006. Digital Atlas of the Virginia Flora. [http://www.biol.vt.edu/digital\\_atlas/](http://www.biol.vt.edu/digital_atlas/) Accessed on 15 March 2006.

VegBank. 2006. Data for communities containing *Cocculus carolinus*. <http://www.vegbank.org/cite/VB.PC.19609.COCCULUSCAROLINA> Accessed on 15 March 2006.

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NOTES ON BASKING BEHAVIOR OF THE STINKPOT (*STERNOTHERUS ODORATUS*) AND ITS IMPLICATIONS FOR PREDATION RISK – Although the ecology and behavior of the Stinkpot (*Sternotherus odoratus*) were reviewed in Carr (1952) and Ernst et al. (1994), little is known about the consequences of basking behavior by this species in Virginia (Mitchell, 1994). This highly aquatic turtle does not usually thermoregulate by basking. Most basking behavior has been described as resting in shallow water or floating at the surface with the top of the carapace exposed to sunlight (Ernst et al., 1994). Stinkpots have been observed occasionally basking on the bank or on limbs of fallen trees (JCM, pers. obs.). What has not been noted is the seemingly unwariness of Stinkpots during this behavior. Unwariness during basking may help us understand the predation success of Bald Eagles (*Haliaeetus leucocephalus*) and other predators on this species. In addition, the biological needs of the Stinkpot may enable them to take advantage of basking sites that are suboptimal for other syntopic turtle species.

On 19 March 2006, one of us (JDK) observed two Stinkpots basking on logs at Waller Mill Reservoir in Williamsburg, James City County, Virginia. These observations were made from a kayak. When approached, the first turtle dropped into the water when JDK was within 1 m of the log. However, the second turtle appeared to be sleeping. Its head was down and resting on the log. It was easily captured. Although the turtle did mouth gape, it never opened its eyes. Some of its behavior can be attributed to the cool water and ambient temperatures. On 4 June 2006, while kayaking the upper reaches of the Chickahominy River in New Kent County, Virginia, just south of Route 155, JDK encountered approximately 12 Stinkpots basking on the bank and various logs. The river in this area is narrow (5 m) and shallow (<1 m) with a dense vegetative overstory. Two Stinkpots were easily captured by hand. These turtles also appeared to be sleeping, as their eyes were closed and the only response to being picked up was mouth gaping.

Bald Eagles have been documented to feed on a wide variety of turtle species. Remains (i.e., shells) of Diamond-backed Terrapins (*Malaclemys terrapin*) and Stinkpots were the most frequently encountered turtle species in and under Bald Eagle nests of the Chesapeake Bay region (Clark, 1982; Markham, 2004). Predation on Diamond-backed Terrapins was attributed to their behavior of only searching the horizon during basking, which makes them susceptible to predation

from above (Carl Ernst pers. comm., in Clark, 1982). No explanation was given for predation on Stinkpots. However, their unwary basking behavior may allow Bald Eagles to catch these turtles while they are on basking logs. Although the dense overstory at the Chickahominy River site would prevent predation by predatory birds, the open water of Waller Mill Reservoir would allow a Bald Eagle to successfully capture a basking Stinkpot. Unwariness on basking sites with overhanging vegetation may also allow other predators, such as raccoons, to catch Stinkpots.

Painted Turtles (*Chrysemys picta*) were the only other turtle species observed basking at the Chickahominy River site. Several Painted Turtles, Sliders (*Trachemys scripta*), and Red-bellied Cooters (*Pseudemys rubriventris*) were observed basking on a large, but separate, log near one of the observed Stinkpots at Waller Mill Reservoir. No Stinkpots were observed at either site basking on logs with larger turtles. Because larger turtles displace smaller turtles for basking sites (Lovich, 1988; Lindeman, 1999), Stinkpots may have to find other suitable basking sites. However, Stinkpots appear to be able to take advantage of basking sites used only by hatchlings or juveniles of the larger species (JDK, pers. obs.). The first Stinkpot encountered at Waller Mill Reservoir was observed basking beside a juvenile Painted Turtle of similar size. In addition, the physiology of Stinkpots may enable them to use marginal basking sites. Since these bottom walkers spend a significant amount of their time underwater, their shells remain wet, and abundant algal growth often covers their shells (Ernst et al., 1994). Thus, basking may not be as critical to their biology as it is to other aquatic turtle species. Basking sites selected may be the result of the inability of this small turtle to compete with larger turtles for prime basking sites. Conversely, physiological needs of Stinkpots may also allow them to exploit basking sites that are suboptimal for other syntopic turtles. Observations of emydid and Stinkpot interactions are needed to further address these inferences.

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#### LITERATURE CITED

- Carr, A. 1940. Handbook of Turtles of the United States and Canada. Cornell University Press, Ithaca, New York. 542 pp.
- Clark, W. 1982. Turtles as a food source for nesting Bald Eagles in the Chesapeake Bay region. *Journal of Field Ornithology* 53: 49-51.
- Ernst, C. H., J. E. Lovich, & R. W. Barbour. 1994. *Turtles of the United States and Canada*. Smithsonian Institution Press, Washington, DC. 578 pp.
- Lindeman, P. V. 1999. Aggressive interaction during basking among four species of emydid turtles. *Journal of Herpetology* 33: 214-219.
- Lovich, J. E. 1988. Aggressive basking behavior in Eastern Painted Turtles (*Chrysemys picta picta*). *Herpetologica* 44: 197-202.
- Markham, A. C. 2004. The influence of salinity on diet composition, provisioning patterns, and nestling growth in Bald Eagles in the lower Chesapeake Bay. Master's Thesis, College of William and Mary, Williamsburg, VA. 127 pp.
- Mitchell, J. C. 1994. *The Reptiles of Virginia*. Smithsonian Institution Press, Washington, DC. 352 pp.
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- EARLY EMERGENCE AND UNUSUAL COLORATION IN EASTERN MILK SNAKES (*LAMPROPELTIS TRIANGULUM TRIANGULUM*) IN THE NORTHERN BLUE RIDGE MOUNTAINS OF VIRGINIA – North American milksnakes (*Lampropeltis triangulum*) are well known for striking geographic variation in color and pattern (Conant, 1943; Williams, 1988; Bartlett & Tennant, 2000; Tennant & Bartlett, 2000; Ernst & Ernst, 2003). Less has been written about the natural history of this species and most of it is anecdotal (e.g., Surface, 1906; Uhler et al., 1939; Mahan, 1956; Lee, 1968; Tryon, 1982). Several authors (e.g., Fitch, 1970, 1999; Klemens, 1993; Palmer & Braswell, 1995; Hulse et al., 2001) have studied habitat use, seasonal activity, reproduction, and population ecology, albeit in

locations outside of Virginia. Williams (1988) and Ernst & Ernst (2003) summarized the natural history of *L. triangulum*. Mitchell (1994) reviewed new and published information on the natural history and phenotypic variation of this snake in the Commonwealth. The earliest known date of activity documented was 18 April and the latest was 19 October. Observations of this snake are still needed to expand our knowledge of its natural history and understanding of its seasonal activity patterns. Phenotypic variation is complex across the state and particularly in the northern Blue Ridge Mountains. We offer additional information on seasonal activity and color and pattern variation in this snake from the northern Blue Ridge.

On 2 February 2006, David Carr found an adult Eastern Milksnake (*L. triangulum triangulum*, total length 565 mm) dead on Berry's Ferry Road adjacent to the University of Virginia's Blandy Experimental Farm in Clarke County, Virginia (39° 03.613' N, 78° 04.903' W). It was killed while crossing a two-lane asphalt road with forest on both sides. One side had a mowed grassy strip about 2.5 m wide between the road and woods. Trees in the woodlot included Red Oak (*Quercus ruber*), Black Oak (*Q. velutina*), White Oak (*Q. alba*), Hackberry (*Celtis laevigata*), and Mockernut Hickory (*Carya tomentosa*). *Smilax* spp. vines and the invasives Bush Honeysuckle (*Lonicera marrowii*) and Japanese honeysuckle (*L. japonica*) occurred in the understory. The substrate had an abundance of leaf litter. The surrounding area has rural residences, an intensive dairy farm, cornfields, hay fields, pastures, limestone outcrops, stacked rock walls, and forest (as described above). The highest daytime air temperature on 2 February was 9.5° C and the lowest was -2° C (University of Virginia, Blandy Farm weather station). Air temperatures over the two-day period prior to the snake's activity were 17° C on 31 January and 17.5° C on 1 February, and the lows for these dates were 0° and -1° C, respectively. The observation of a road-kill on 2 February extends the earliest known activity date in Virginia by an additional 75 days. There were no obvious injuries or marks that would have suggested that a predator had pulled it out of its hibernation site. Thus, the likely conclusion is that this individual responded to the warm winter temperatures.

The snake found DOR on 2 February exhibited the colors and patterns typical of Eastern Milksnakes occurring in the mountains of Virginia (see Mitchell, 1994 for full descriptions). Like other normally patterned *L. triangulum* from the northern Blue Ridge Mountains, it had reddish-brown body blotches edged in black, and the neck blotch is connected to the one on the dorsum of the head to form a typical Y-shaped

pattern of normal background color in the center (Mitchell, 1994). Most of the dorsal blotches had extensions on each side that reached the ventral scales, a feature not characteristic of most Eastern Milksnakes. Smaller, lateral black blotches in typical phenotypes alternate with the dorsal blotches and encroach onto the venter as well. Ventral scales of normal milksnakes phenotypes in Virginia are cream to yellowish and peppered variously in black; they alternate with black half- to full-sized ventral scales. In contrast, the DOR snake had an immaculate white venter with few black specks and lacked the black half and full scales completely (Fig. 1).

Another *L. triangulum*, found alive on Blandy Farm on 6 April 2006, exhibited the typical pattern as noted above but differed in coloration. Each body blotch on this snake was orange with a narrow black border; blotch count was 36 (within the range of 26-41 known for this region, Mitchell, 1994). Dorsal body blotches had no lateral extensions and most terminated on scale row 5 (Fig. 2). The neck blotch was connected to the one on the head but the single, central patch of background color lacked the upper arms of the normal Y-shape marking. The alternating lateral blotches were a combination of black and orange and only reached the lateral margins of the ventral scales. Background color of Eastern Milksnakes in Virginia is normally brown to gray variously peppered with black specks (Mitchell, 1994). The snake found on Blandy Farm had a light orange-tan background speckled in black. Its venter was orange with some black peppering that alternated irregularly with completely black scales. The black eye-jaw stripe was present on this snake, a feature characteristic of Virginia Milksnakes. Its ventral scale count was 194 and subcaudal scale count 54, both



Fig. 1. Ventral pattern of a *Lampropeltis triangulum* from Clarke County, Virginia, with a nearly immaculate white venter and only the lateral blotches encroaching onto the ventral scales. Photo by Carrie Seltzer.



Fig. 2. An unusually-colored *Lampropeltis triangulum* from Clarke County, Virginia. Dorsal blotches are orange and the background color is light tan. The dorsal scales are peppered with black specks. Photo by Carrie Seltzer.

within the normal range known for this area (Mitchell, 1994). Despite the unusual orange coloration, this individual would readily key out using pattern and scale characters as *Lampropeltis t. triangulum*.

Other milksnakes from this region exhibit phenotypes that differ from the normal Eastern Milksnake form. Baird & Girard (1853) described a milksnake from Clarke County, Virginia, as *Ophibolus clericus* (USNM 2380) because the dorsal pattern appears as a series of black rings alternating with "ash-colored" rings. Body blotch count was 29, the blotches extended to near the venter, and the venter was "yellowish white with distinct black quadrate black blotches." This taxon was later synonymized by Stejneger & Barbour (1917) in recognition that *O. clericus* was only an unusual Eastern Milksnake. Another milksnake collected in Shenandoah National

Park (SNP) in 1962 (USNM 148479) has 26 dorsal blotches that extend to scale row 1 and the neck blotch is not connected to the one on the head. A milksnake found DOR on Skyline Drive in SNP in the 1980s, Rockingham County, had 29 orange blotches that nearly overlapped the entire body and a neck blotch that did not connect to the head blotch (JCM, pers. obs.). Williams (1988) considered the original USNM specimen from Clarke County an intergrade between *L. triangulum triangulum* and *L. triangulum elapsoides*. Presumably, the two noted from SNP would also fit into this category.

*Lampropeltis triangulum* populations in the upper Shenandoah Valley and northern Blue Ridge Mountains in Virginia may possess complex genotypes that

underlie the range of phenotypes noted from Clarke County and SNP. This may not be the case in more southern parts of the Blue Ridge and in the Ridge and Valley physiographic provinces (Mitchell, 1994). Clearly, the pattern and color complexity of milksnakes in the northern Blue Ridge Mountains, as well as the natural history and ecology of these populations, warrants further study. Careful notes on all aspects of phenotypic variation, microhabitat, weather, and behavior should be accumulated on all milksnakes in the Virginia Blue Ridge and Shenandoah Valley so that the causes and ramifications of the extensive range of variation in this species can be better understood.

#### LITERATURE CITED

- Baird, S. F., & C. Girard. 1853. Catalogue of North American Reptiles in the Museum of the Smithsonian Institution. Part 1, Serpents. Smithsonian Miscellaneous Collection 2: 1-172.
- Bartlett, R. D., & A. Tennant. 2000. Snakes of North America, Western Region. Gulf Publishing Company, Houston, TX. 311 pp.
- Conant, R. 1943. The milk snakes of the Atlantic Coastal Plain. Proceedings of the New England Zoological Club 22: 3-24.
- Ernst, C. H., & E. M. Ernst. 2003. Snakes of the United States and Canada. Smithsonian Institution Press, Washington, DC. 668 pp.
- Fitch, H. S. 1970. Reproductive cycles in lizards and snakes. University of Kansas Museum of Natural History Miscellaneous Publication 52:1-247.
- Fitch, H. S. 1999. A Kansas Snake Community: Composition and Changes over 50 Years. Kreiger Publishing Co., Malabar, FL. 165 pp.
- Hulse, A. C., C. J. McCoy, & E. Censky. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press, Ithaca, NY. 419 pp.
- Klemens, M. W. 1993. Amphibians and Reptiles of Connecticut and Adjacent Regions. State Geological & Natural History Survey of Connecticut, Hartford, CT. 318 pp.
- Lee, D. S. 1968. Springs as hibernation sites for Maryland's herpetofauna. Bulletin of the Maryland Herpetological Society 4: 82-83.

Mahan, H. D. 1956. Nocturnal predation on Song Sparrow eggs by milksnake. *Wilson Bulletin* 68: 245.

Mitchell, J. C. 1994. *The Reptiles of Virginia*. Smithsonian Institution Press, Washington, DC. 352 pp.

Palmer, W. M., & A. L. Braswell. 1995. *Reptiles of North Carolina*. University of North Carolina Press, Chapel Hill, NC. 412 pp.

Stejneger, L., & T. B. Barbour. 1917. *A checklist of North American amphibians and reptiles*. Harvard University Press, Harvard, MA. 125 pp.

Surface, H. A. 1906. The serpents of Pennsylvania. *Pennsylvania State Department of Agriculture Monthly Bulletin, Division of Zoology* 4: 113-202.

Tennant, A., & R. D. Bartlett. 2000. *Snakes of North America, Eastern and Central Regions*. Gulf Publishing Company, Houston, TX. 587 pp.

Tryon, B. W. 1982. Additional instances of multiple egg-clutch production in snakes. *Transactions of the Kansas Academy of Science* 87: 98-104.

Uhler, F. M., C. Cottam, & T. E. Clarke. 1939. Food of snakes of the George Washington National Forest, Virginia. *Transactions of the Fourth North American Wildlife Conference* 1939: 605-622.

Williams, K. L. 1988. Systematics and Natural History of the American Milk Snakes, *Lampropeltis triangulum*. Milwaukee Public Museum, Milwaukee, WI. 176 pp.

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OPPORTUNISTIC SCAVENGING BY EASTERN AMERICAN TOAD (*BUFO AMERICANUS AMERICANUS*) TADPOLES ON A DEAD RED-SPOTTED NEWT (*NOTOPHTHALMUS VIRIDESCENS VIRIDESCENS*) – The diet of most tadpoles is assumed by many to consist of algae, detritus, and protozoa, but many tadpole species supplement this herbaceous diet with animal protein (Alford, 1999). On 14 April 2005 at 1800 h EDT, one of us (JDG) observed a feeding aggregation of Eastern American Toad (*Bufo americanus americanus*) tadpoles consuming a dead Red-spotted Newt (*Notophthalmus viridescens viridescens*). The shallow pond, located in White Oak Mountain Wildlife Management Area, Pittsylvania County, Virginia (36° 46' 43.1" N, 79° 19' 56.4" W, NAD 83), measured 17 m by 61 m. Water temperature was 25° C. The tadpoles appeared to be concentrated around two openings in the body wall of the newt. The two openings were located inferior to each forelimb. Abdominal organs were protruding out of one opening. Total length of this male newt was 84 mm. The death of the newt was likely the result of an aborted predation event. When examined, the newt showed no signs of ill health except for the two holes in its body. The newt was checked again four days later. All of its skin was completely stripped to the muscle. No tadpoles were observed feeding on the carcass at this time, although thousands of tadpoles were present in the pond. We could not find the newt the next day when the pond was last checked.



Fig. 1. American Toad tadpoles scavenging an adult male Red-spotted Newt in Pittsylvania County, Virginia.

Newts are known to have tetrodotoxin and other chemicals concentrated in granular glands in the skin (Brodie & Johnson, 1974; Duellman & Trueb, 1994). Tetrodotoxin is a potent neurotoxin and, along with other skin secretions, constitute a powerful emetic. Adult newts have one-tenth the toxicity of the juvenile eft stage (Brodie, 1968). This makes them less toxic but still unpalatable to many predators. Why were the American Toad tadpoles able to eat the skin of the dead adult Red-spotted Newt and not apparently be affected by the tetrodotoxin? Tadpole behavior was normal; no abnormal movements or swimming behavior were observed. *Bufo americanus* tadpoles themselves are toxic to predators at metamorphic stages of development, when they contain bufotoxin, but not during intermediate stages of growth (Brodie et al., 1978; Formanowicz & Brodie, 1982; Brodie & Formanowicz, 1987). Elucidation of the ability of *B. americanus* tadpoles to consume newt skin without apparent ill effects may reveal new physiological or pharmacological properties in these aquatic vertebrates. Tetrodotoxin may also simply decompose quickly after death allowing the tadpoles to freely consume the skin.

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#### LITERATURE CITED

- Alford, R. A. 1999. Ecology, resource use, competition, and predation. Pp. 240-278 *In* McDiarmid, R. W., & R. Altig (eds.), *Tadpoles: The Biology of Anuran Larvae*. University of Chicago Press, Chicago, IL.
- Brodie, E. D., Jr. 1968. Investigations on the skin toxin of the Red-spotted Newt, *Notophthalmus viridescens viridescens*. *American Midland Naturalist* 80: 276-280.
- Brodie, E. D., Jr., & D. R. Formanowicz, Jr. 1987. Antipredator mechanisms of larval anurans: protection of palatable individuals. *Herpetologica* 43: 369-373.
- Brodie, E. D., Jr., D. R. Formanowicz, Jr., & E. D. Brodie, III. 1978. The development of noxiousness of *Bufo americanus* tadpoles to aquatic insect predators. *Herpetologica* 34: 302-306.
- Brodie, E. D., Jr., & J. A. Johnson. 1974. Toxicity of the urodele amphibians *Taricha*, *Notophthalmus*, *Cynops*, and *Paramesotriton* (Salamandridae). *Copeia* 1974: 506-511.
- Duellman, W. E., & L. Trueb. 1994. *Biology of Amphibians*. Johns Hopkins University Press, Baltimore, MD. 696 pp.
- Formanowicz, D. R., Jr., & E. D. Brodie, Jr. 1982. Relative palatability of members of a larval amphibian community. *Copeia* 1982: 91-97.
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## MISCELLANEA

## Reviews

*Nature-Friendly Garden, Creating a Backyard Haven for Plants, Wildlife, and People* by Marlene A. Condon. Stackpole Books, Mechanicsburg, PA. 160 pp, 85 color photographs. ISBN-13: 978-0-8117-3261-1. Paper \$19.95.

I do not like the American lawn. Never have. My third of an acre in the suburbs of western Henrico County has six mature hardwood trees in the back and nine (plus two loblolly pines) in the front, minus a large red oak that died recently. Some of it is landscaped with shrubs, azaleas, and other ornamentals. My ex created and maintained these landscaped areas but they are now overgrown and in need of much work. I finally realized last week what I wanted to do with it: help develop it into an eastern deciduous forest. I already have the canopy and some of the shrub layer in limited spots. So, all I need to do is add sub-canopy trees, more shrubs, an herbaceous layer, and start up the forest floor. That will give me the properly structured forest characteristic of this region. I will add a butterfly and insect garden, too. Then I will have only a little bit of yard to mow, mostly the county right-of-way.

How am I going to accomplish that since I am a zoologist and plants were just something I never could get too excited about? Along comes Marlene Condon's book. She lives near Crozet west of Charlottesville and has been practicing and studying backyard landscapes and the animals they support for years. She is an accomplished nature photographer and writer. What better thing to do than to write a book on something about which one is passionate. I am glad she did.

I like her philosophy. Plants, wildlife, and people go together. They are made to coexist. People become disconnected from nature when they live in houses surrounded by manicured lawns made of introduced and genetically altered grass that requires lots of chemicals and human energy to maintain. What a waste of energy. What a serious source of pollution. And, what a sad thing to be devoid of local nature. Condon's book provides many examples of how we can all learn to bring nature back into our lives, right in our own yards.

The book contains eleven chapters, along with an introduction and some final thoughts. Chapter 1 starts with descriptions and lessons about Understanding Natural Processes. The lay reader will better understand what Condon is proposing after reading it. She discusses *ecological* (emphasis mine) processes and interactions among species of different groups. She uses

personal anecdotes to make the reading enjoyable and user friendly. Chapter 2 follows with the all-important discussion of Planning Your Garden. That is my problem, poor, or rather, no planning save what strikes me as useful. I love the first line to her second paragraph, "The first step is to limit the amount of lawn grass." My kind of yard owner. She talks about soils and their importance to plants. And she spends most of this chapter describing what attracts wildlife. The five-page section that follows this chapter is a long list of plant names and the kinds of wildlife they attract. Boy, I sure can use that!

Her philosophy shows up again in Chapter 3 – Allowing Your Garden to Work for You. Natural processes work at all levels and change will happen, whether you want it to or not. What your yard looks like in year one will not be what it looks like in year five. Limit the lawn (yes!) and use natural and naturalized plants for your landscaping. I love the next part – "Let Leaves Lie." But watch out for too much mulch, such as volcano mulching around your trees.

Chapter 4 is a lengthy overview of how to and how not to feed wildlife and provide shelters for different kinds of animals. There is a great photograph of a raccoon reaching into a bird feeder (p. 38) and one of a squirrel inside a squirrel-proof feeder (p. 40). I am not a wise bird feeder, so her section of birdseeds and other foods was especially enlightening. Wildlife shelter comes in all sorts of size and shapes. Condon focuses on a variety of artificial boxes and the like for a wide array of wildlife, even toads. Her special section at the end of this chapter provides tips on rototilling, pruning, lighting, bug zappers, hummingbird food, spider webs, and mushrooms. Chapter 5 enters the aquatic resources arena and provides much information on containers for birds and insects and several pages on small ponds. I appreciate Condon's love of all wildlife, including snakes. She shows how exciting a place can be with a balance of terrestrial and aquatic resources in one's yard. Her thoughts about structures are always described with the animal's behavior and welfare in mind.

Predators is the subject of Chapter 6. Actually, it is titled, "Accepting Predators." Predators are not "vermin" that need to be culled to keep the others you like at high levels but are also components of the natural system. Hawks, owls, foxes, and snakes are important visitors and residents of gardens and landscaped backyards. Although Condon tries to get people to accept predators, she also provides tips on reducing predation at feeders and nest boxes. Domestic predators, dogs and cats, deserved a special section.

Cats are notorious for killing migratory birds, as well as many other forms of wildlife. She does not delve into the thorny issue of feral cat colonies or elimination altogether, but rather on keeping one's pet cat indoors.

Once you attract wildlife to your yard or garden, then what? Chapter 7 contains a series of tips on watching animals in your yard and pond, on watching birds, and on chance encounters with animals like the black bears, flying squirrels, and treefrogs. The choice of binoculars deserved 2.5 pages of explanation. So, what does one do after or during your wildlife watching? You record your observations, the subject of one entire chapter (number 8). Condon is a seasoned wildlife watcher, but she is also a seasoned note-taker. How do you identify these animals? Where does one obtain resources to find out? What is the difference between observation and interpretation? Be careful of the difference between recording facts and interpretations of the facts. Use your observations in a smart way to modify your plans and habitats so that they can better serve the wildlife. And just watch them with no disturbance, taking notes all the while, of course. Sounds like Condon could have gotten higher degrees in animal behavior or behavioral ecology.

Some wildlife can pose challenges. Deer, for example, are well known for eating one's prized landscape plants and garden vegetables (Chapter 9). How to deter them without killing them is the focus here. Black bears in some regions, like at her house, stop by occasionally. What does one do if they tear up your boxes and shelters? Other problems exist with mice, opossums, groundhogs, raccoons, coyotes, moles, Japanese beetles, aphids, caterpillars, spiders, bagworms, some birds, and snakes. Condon provides ways of dealing with these species that does not force you to kill them or use chemicals to control them.

Condon includes an important chapter called "Accessible Gardening." She notes that her diagnosis of rheumatoid arthritis made her realize that persons with disabilities or physical injuries can do most, if not all, of the things in one's garden or yard that others do. One only has to design the landscape in such a way to allow access on the ground, on high plants, and into pools. Don't give up just because of a limitation. And be attentive to all things big and small. She relates how she learned of Worm Snakes and Short-tailed Shrews by being attentive and quiet.

Gardening can provide healthy exercise but also hidden dangers. Use this area for physical work and a source of stress release, but also be careful of stinging and biting insects, venomous snakes, and human-caused hazards. Condon (pers. comm.) told me recently of several Copperheads that had been seen at her house, including one that took up residence under her garage.

She is patiently trying to prevent their decision to stay there over winter.

Chapter 11 is a personal story about how gardens and landscaped yards can be sources of emotional and spiritual healing. Such places are now well known to help lower blood pressure and reduce stress. If one cannot find a public place nearby that provides this ecological service, then make it yourself, right in your yard.

The technical aspects of this book are accurate and detailed. The common and scientific names lists in the back are up to date. The captions to the excellent and well-chosen photographs on most of the pages in the book provided by Condon herself are accurate and include information not in the text. The terminal section is a list of commercial, governmental, and university resources where the reader can find other sources of information. The book is printed on heavy glossy paper that will stand up to much handling.

Despite the title of this book suggesting that it deals largely with plants and landscaping, it is actually more about wildlife and one's own peace of mind when one has lots of nature in one's yard. It does not take large yards to make this happen. All one needs is a small place to be creative with nature. This is the book that will help you make that happen. I will certainly refer to it many times during the revitalization of my own patch of suburban forest.

Joseph C. Mitchell  
Department of Biology  
University of Richmond  
Richmond, Virginia 23173

## Reports

### 1. President's Report

This past year was an active one for the VNHS. A number of members participated in the Potomac Gorge BioBlitz in late June. The results of that survey will be published in a future issue of *Banisteria*. During the year we also discussed ways to increase membership (see Minutes of the Council Meeting) and to increase visibility and use of our website. If you haven't looked at the Society's website ([va-nhs.org](http://va-nhs.org)) you should do so – it is most attractive. We have asked John White, VNHS Webmaster, to add a "photo of the month" to the site (submissions welcome) and to work on adding links to other natural history-related organizations (suggestions may be e-mailed to him: [vhs.webmaster@verizon.net](mailto:vhs.webmaster@verizon.net)). His report to the Council noted that most visitors to the website were, as expected, from Virginia, but the next



highest locations represented were less expected: California and New York. He has only been keeping records since July, so it will be interesting to see how usage records develop.

A highlight of the fall Council meeting was discussion of two potential conferences, the first in celebration of Dr. Richard Hoffman's 80<sup>th</sup> birthday. It will be held at the new Virginia Museum of Natural History building in Martinsville, during late September of 2007. We also discussed ideas for a conference on the History of Virginia Natural History, and we hope to work with Hampden-Sydney College in developing that event (hopefully during 2008). It has been an honor and pleasure to serve as VNHS president. I look forward to even more exciting times for the society in the next few years.

Respectfully submitted,  
Judith E. Winston, VNHS President

## 2. Minutes of Fall 2006 Executive Committee Meeting

Hampden-Sydney College, Gilmer Hall, Hampden-Sydney, Virginia, December 2, 2006, 1:20 to 3:15 PM

Council members in attendance: Richard Hoffman, Michael Kosztarab, Anne Lund, Tom McAvoy, Janet Reid, Steve Roble, and Judy Winston.

Judy Winston, Society President, presided. She presented a brief report from our webmaster to show the kinds of visitation to our site.

The minutes of the 2005 Council meeting had been approved earlier. The secretary/treasurer reported a membership of 123 (paid for 2006), down a little from 2005, and as of October 31, 2006, the treasury contained \$5,569.29. A membership list was circulated for council members to gather information from and to correct any errors.

There was a discussion of ways to increase membership by contacting naturalists at the State Parks and other agencies. We will work on an updated leaflet to be distributed more widely.

There was a discussion that the Society would continue its relationship with the Virginia Academy of Science as the Biodiversity and Natural History Section.

It was agreed that we would send out letters for renewal of membership for 2007.

The editors reported that the fall issue of *Banisteria* was almost ready and would go to press early in 2007. Printing costs were reviewed, as well as quality of

printing and how to increase submissions to the journal.

Results of the Potomac Gorge BioBlitz (June 2006) will be published in a future issue of *Banisteria*. With continued discussion of BioBlitz events for the future and the ones from the past, it was announced that there would be no BioBlitz for 2007 for Virginia as far as the Council knows.

Two people were suggested as nominees for the one expiring councilor position for the Council. These nominees will be contacted for their permission to be included as candidates and for their biographies, and the ballot will be prepared for the next issue of *Banisteria*. Several potential Vice President nominees were mentioned and those individuals will be contacted to learn of their interest in being placed on the ballot.

There was discussion of the Society sponsoring a conference in late September of 2007 with the Virginia Museum of Natural History to recognize the contributions of Richard Hoffman to Virginia's natural history collections and heritage. There was further discussion about a later conference on "The History of Natural History in Virginia." Roble will prepare draft proposals for both conferences.

The meeting was adjourned at 3:15 PM.

Respectfully submitted,  
Anne Lund, Secretary/Treasurer

## 3. Secretary/Treasurer's Report

We have 126 members of record for 2006, 18 of which are institutions or libraries. Our treasury presently holds \$6,133.35 as of December 31, 2006.

As always, we encourage our present and active members to recruit members for the Society. We ended 2005 with a membership of 128, so we want to stay at least even for 2006 and begin to grow again for 2007. (We have 31 paid members for 2007 and have only begun to send out the notice for renewals!)

We continue to be grateful to Hampden-Sydney College for support with the paperwork/computer work concerning our treasury, membership records, and mailings.

Please submit all enquiries about membership in the Society or about past issues of *Banisteria* to: Dr. Anne Lund, Virginia Natural History Society, Box 62, Hampden-Sydney, Virginia 23943, or email, [alund@hsc.edu](mailto:alund@hsc.edu).

Respectfully submitted,  
Anne Lund, Secretary/Treasurer

#### 4. Coeditors' Report

We anticipate, believe it or not, being on schedule in 2007 with a spring and a fall issue. This is largely due to a long piece written by the late Roger de Rageot in the 1960s on natural history in the Dismal Swamp. The manuscript languished for many years, indeed several decades, and was never published by him during his lifetime. It is full of observations on plant and wildlife of the Great Dismal Swamp, and clearly a place that he loved. We are not sure at this writing whether it will be published in one or two parts. Whatever the case, its publication will allow us to fill more pages and catch up with incoming manuscripts.

And speaking of incoming manuscripts: we seem to be like the proverbial squeaky wheel – please send us your manuscripts. Dust off those old theses and reports. Write up a note on an interesting and unique observation you made last year, indeed, 10, 20, 30, or more years ago. Make a contribution to Virginia's natural history.

We also continue to seek peer reviewers for the manuscripts and notes that are sent to us. Please let us know if you are willing to help. All that is required is to be a good reader and point out the mistakes, problems with working, gaps in delivery and information, etc. We, the editors, can work with the authors to ensure the manuscript is in the correct format.

If you have not kept up, please note that we now ask for abstracts and key words. This will allow *Banisteria* to be indexed and included on-line by some of the major scientific literature search services out there.

We have also placed some of the earlier articles and shorter contributions (as PDF documents) on the Virginia Natural History Society's web site ([va-nhs.org](http://va-nhs.org)). Download them and send them to friends. Maybe you can help stimulate them to write manuscripts for *Banisteria*.

Respectfully submitted,  
Joe Mitchell and Steve Roble, Coeditors

#### 5. Webmaster's Report

As suggested at the Executive Committee meeting, the link to *Banisteria* on the main page was made more prominent. Seventeen past articles have been posted on the website as downloadable PDF documents. The VNHS website now as a shorter, alternate URL ([va-nhs.org](http://va-nhs.org)). Over the next several months, website development will be ported to a new platform. During this time website functionality should remain intact. If anyone has any suitable links to add to our links page

please send them to me at [vhs.webmaster@verizon.net](mailto:vhs.webmaster@verizon.net).

Respectfully submitted,  
John White, VNHS Webmaster

#### Announcements

##### 1. Election Ballot and Dues Renewal

Under separate cover, members will receive a dues renewal notice for 2007 and a ballot for the election of a new Vice President and one Councilor. Membership in the Virginia Natural History Society is on a calendar year basis. The society needs to elect a new councilor for a four-year term to replace Mike Donahue (his term expires in December). Current Vice President Tom McAvoy will automatically become President in January. Please return your membership renewal form and election ballot by **April 15, 2007** to Dr. Anne Lund, Virginia Natural History Society, Box 62, Hampden-Sydney, Virginia 23943.

##### 2. Back issues of *Banisteria* available for sale

Back issues of most numbers of *Banisteria* can be purchased from the Secretary/Treasurer. The supply of numbers 7, 15, and 21 is exhausted. The cost is \$10.00 per number (add \$2.00 per issue for foreign postage), except for **Nos. 1-6 (reduced to \$5.00)** and **No. 13 (\$18.00; this issue contains the proceedings of the Big Levels Symposium)**. A spiral bound reprint of "Common and Occasional Bryophytes of the Virginia Piedmont" by David Breil (originally published as pages 3-53 in *Banisteria* 21) is available for \$10.00. The table of contents for each issue can be viewed on the society's website at [va-nhs.org](http://va-nhs.org). A printable order form for back issues is also available on the website.

##### 3. Back issues of *The Raven* available on-line

With financial assistance from the Virginia Society of Ornithology (VSO), the Center for Conservation Biology (CCB) at the College of William & Mary has recently prepared a digital library of all issues of *The Raven* from 1930 to 2005 (Volumes 1-76). The issues can be downloaded as PDF documents from CCB's website (<http://ccb-wm.org/raven/ravenpage.htm>) and will soon be available also on DVD. Newly prepared indexes to titles and bird species for Volumes 1-74 of *The Raven* are available as Rich Text Format files at VSO's website (<http://www.virginiabirds.net/>).

**Virginia Natural History Society**  
**Website: va-nhs.org**

**General Information**

The Virginia Natural History Society (VNHS) was formed in 1992 to bring together persons interested in the natural history of the Commonwealth of Virginia. The VNHS defines natural history in a broad sense, from the study of plants, animals, and other organisms to the geology and ecology of the state, to the natural history of the native people who inhabit it. The goals of the VNHS are to promote research on the natural history of Virginia, educate the citizens of the Commonwealth on natural history topics, and to encourage the conservation of natural resources. Dissemination of natural history information occurs through publication of the journal *Banisteria*, named for John Banister (1650-1692) who was the first university-trained naturalist to work in Virginia. The first issue was published in 1992, and the journal is published twice per year in spring and fall. Articles cover a wide array of subjects, and prospective authors are encouraged to submit manuscripts on any aspect of natural history in Virginia; book reviews and biographies of relevance to natural history in Virginia are also welcomed. The editors of *Banisteria* will also consider manuscripts on any aspect of natural history from neighboring states if the information concerns a species native to Virginia or the topic is directly related to regional archeology, anthropology, botany, ecology, zoology, paleontology, geology, geography, or climatology. Manuscripts are peer-reviewed for suitability and edited for inclusion in the journal. Page charges (\$15/page) are waived for VNHS members. The society's website contains instructions for authors, the titles (and abstracts beginning in 2004) of all *Banisteria* papers, and downloadable versions (pdf format) of selected articles from past years.

**Memberships**

The VNHS is open to anyone with an interest in natural history and welcomes participation by all members in society activities and efforts to promote education and conservation. Membership includes a subscription to *Banisteria* and invitation to the annual Virginia BioBlitz. Annual dues for members are \$20 (per calendar year); library subscriptions are \$40 per year. Checks should be sent to the Secretary/Treasurer, who also has back issues of *Banisteria* available at \$10.00 each (except Nos. 1-6 are \$5.00 each and No. 13 is \$18.00). The VNHS is a tax-exempt, nonprofit, society under Section 501(C)3 of the IRS. We welcome donations to support our mission in Virginia.

**The Virginia Natural History Society**  
**Application for Membership**

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Zip Code \_\_\_\_\_

Phone \_\_\_\_\_

Email \_\_\_\_\_

Area(s) of Interest \_\_\_\_\_

**ANNUAL DUES AND SUBSCRIPTIONS**  
**TO *BANISTERIA***

(memberships and subscriptions are by calendar year; subscribers/members outside the United States should add \$3.00 for additional postage)

- ☐ \$500.00 Life (not annual)
- ☐ \$300.00 Benefactor
- ☐ \$100.00 Patron
- ☐ \$50.00 Supporting
- ☐ \$40.00 Institutional
- ☐ \$25.00 Family
- ☐ \$20.00 Regular
- ☐ \$5.00 Student (see below)

- ☐ I have added a contribution of \$ \_\_\_\_\_  
to my membership dues.

The special student rate is applicable only when accompanied by the following certification signed by a faculty advisor.

Institution \_\_\_\_\_

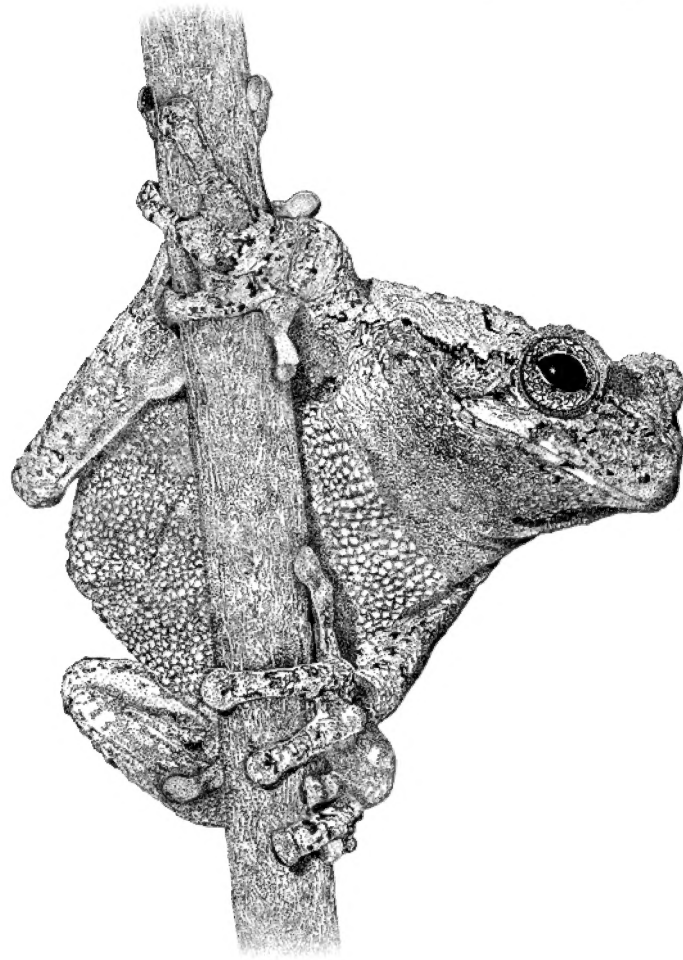
Advisor \_\_\_\_\_

Date \_\_\_\_\_

**Make checks or money orders payable to:**  
Virginia Natural History Society

**Send membership form and dues to:**  
Dr. Anne Lund, Secretary-Treasurer  
Virginia Natural History Society  
Box 62  
Hampden-Sydney, Virginia 23943

*Gray Treefrog*  
*Hyla versicolor*  
Greene County, Virginia



*del. W. Brown*